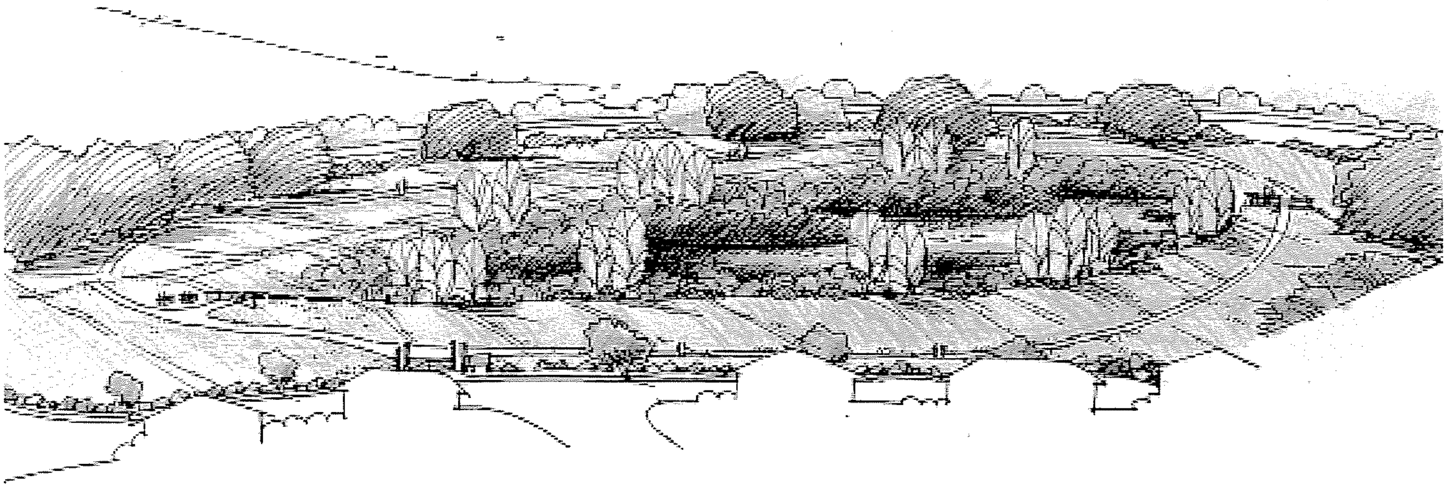
Volume 1 Engineers' Report

May 23, 2002

Los Capitancillos
Freshwater Wetland Mitigation Project
Planning Study



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LOS CAPITANCILLOS FRESHWATER WETLAND MITIGATION PROJECT

PLANNING STUDY
VOLUME ONE: ENGINEERS REPORT
VOLUME TWO: DRAFT ENVIRONMENTAL IMPACT REPORT

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MAY 2002

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Engineers Report

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and
Parikh Consulting, Inc.

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PWA REF. #1426

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No other person or entity shall be entitled to rely on the services, opinions, recommendations, plans or specifications provided pursuant to this agreement without the express written consent of Philip Williams & Associates, Ltd., 720 California Street, Suite 600, San Francisco, California 94108.

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ENGINEERING PLANS

Preliminary Design (30% Complete) Engineering Plan Set

SUMMARY

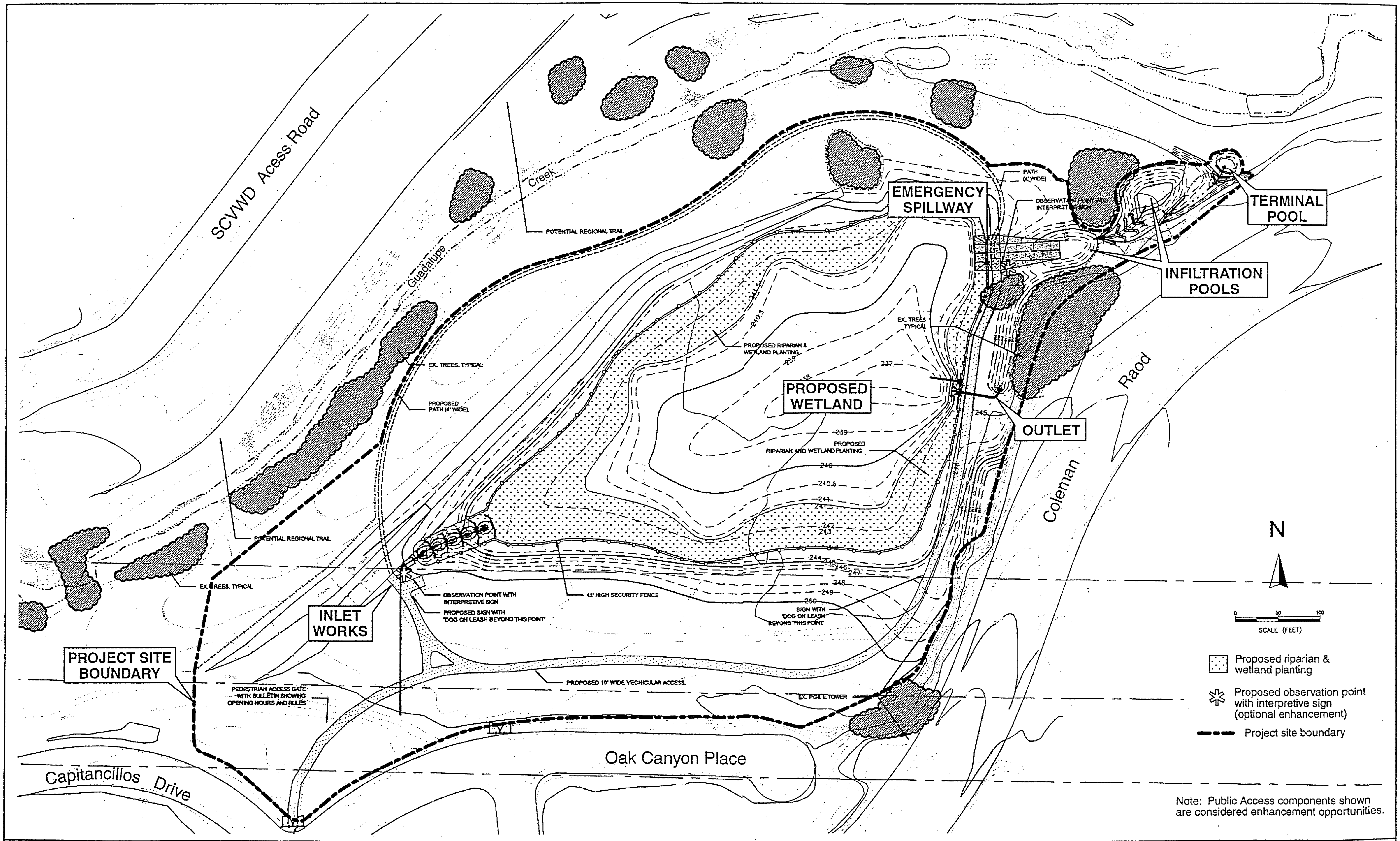
The Los Capitancillos Freshwater Wetland Project is proposed to meet freshwater wetland mitigation requirements imposed on the Santa Clara Valley Water District, primarily for Stream Maintenance work conducted within the District during 1997 and 2000. The District considered several sites during preliminary screening for determining the project location. The Los Capitancillos site was selected for further study because it was owned by the District, adjacent to the District's Guadalupe Creek restoration project and an existing District water supply, and had a high likelihood of meeting the project schedule. The concept for the wetland design was initially described in the 1997 Urgent Sediment Removal Mitigation and Monitoring Plan where potential for an open water wetland on the Los Capitancillos site, supplied with water from the Almaden Valley Pipeline and supporting freshwater wetland vegetation typical of the Santa Clara Valley area, was identified.

In 2000, the District hired a consultant to assist in the development of this project. This Planning Study, consisting of an Engineer's Report (Volume One) and a Draft Environmental Impact Document (Volume Two) documents the development of the wetland design from screening of conceptual options to preliminary design of the proposed project.

The proposed project consists of a single pond, approximately three acres in size, an average of three feet in depth, planted with emergent vegetation at the perimeter and riparian vegetation in a band around the water's edge as shown in figures S-1 and S-2. Because of the need for an appropriate planting medium and water-retaining liner, as well as concerns regarding the potential for mercury methylation at the site, clean soil will be imported and placed on the wetland bottom as a liner. Water levels in the pond will remain at a design level ± 0.5 feet most of the year. In early fall, the wetland will be drawn down to be empty for two weeks, and then refilled as a measure to interrupt the bullfrog reproductive cycle at the site.

Direct interactions between the wetland and Guadalupe Creek will be negligible. There will be no direct outflows to Guadalupe Creek from the wetland except under extreme hydrologic conditions. Instead, any water from the wetland released during routine operations will be directed into a percolation system. In addition, flow elevations on Guadalupe Creek will have to exceed their estimated 100-year levels to overtop the bank of the wetland.

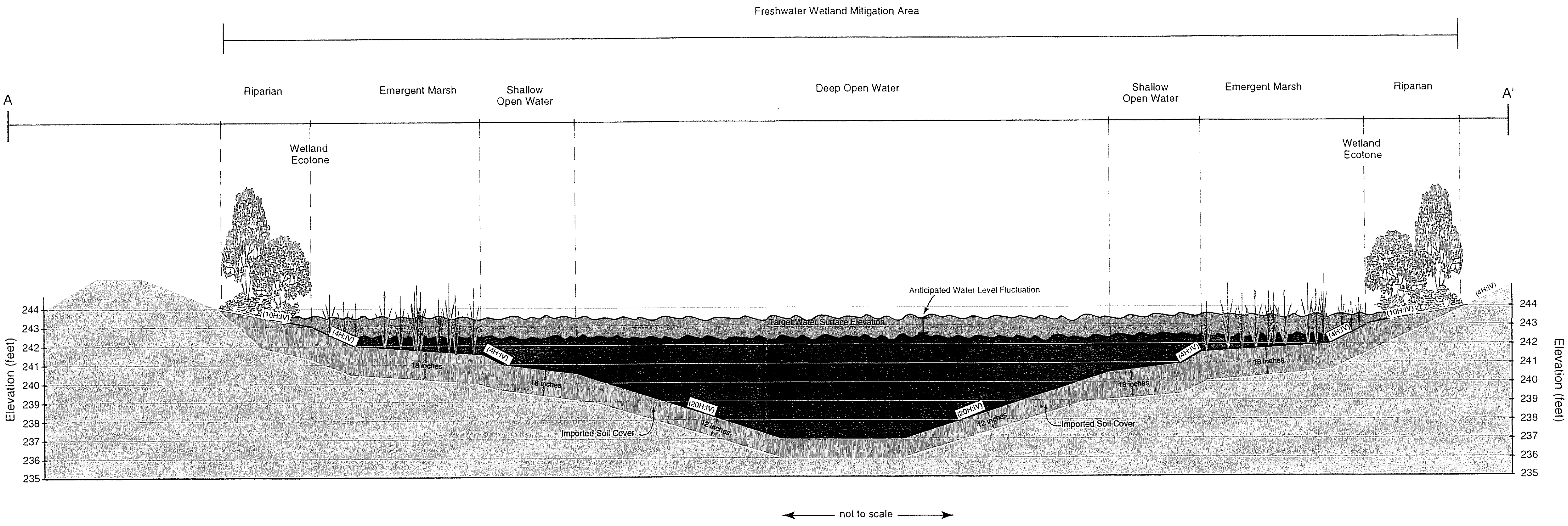
Volume One of this study presents the selection and design process for the proposed project. Volume Two presents the environmental setting and impact analysis in accordance with the California Environmental Quality Act (CEQA).


SCVWD Acess Road
Guadalupe
Creek
POTENTIAL REGIONAL TRAIL
EX. TREES, TYPICAL
PROPOSED PATH (4' WIDE)
POTENTIAL REGIONAL TRAIL
EX. TREES, TYPICAL
EMERGENCY SPILLWAY
PATH (4' WIDE)
OBSERVATION POINT WITH INTERPRETIVE SIGN
TERMINAL POOL
INFILTRATION POOLS
EX. TREES TYPICAL
PROPOSED RIPARIAN & WETLAND PLANTING
PROPOSED WETLAND
OUTLET
PROPOSED RIPARIAN AND WETLAND PLANTING
237
239
240
240.5
241
241.5
242
243
244
245
246
247
248
249
250
SIGN WITH 'DOG ON LEASH BEYOND THIS POINT'
Coleman
Raod
INLET WORKS
OBSERVATION POINT WITH INTERPRETIVE SIGN
PROPOSED SIGN WITH 'DOG ON LEASH BEYOND THIS POINT'
42" HIGH SECURITY FENCE
PROJECT SITE BOUNDARY
PEDESTRIAN ACCESS GATE WITH BULLETIN SHOWING OPENING HOURS AND RULES
PROPOSED 10' WIDE VECHICULAR ACCESS.
EX. PG&E TOWER
Oak Canyon Place
Capitancillos Drive
N
0
50
100
SCALE (FEET)
Proposed riparian & wetland planting
Proposed observation point with interpretive sign (optional enhancement)
Project site boundary

Note: Public Access components shown are considered enhancement opportunities.

LOS CAPITANCILLOS WETLAND SITE PLAN

FIGURE S-1



Target Mitigation Site Habitat Mosaic

Deep Open Water = 48.5% (2.5' - 6' deep)

Shallow Open Water = 13.5% (1.5' - 2.5' deep)

Emergent Marsh = 19% (0' - 1.5' deep)

Riparian = 19%

Source: H.T. Harvey & Associates

LOS CAPITANCILLOS WETLAND DESIGN CROSS-SECTION

FIGURE S-2

1. INTRODUCTION

The purpose of the Los Capitancillos Freshwater Wetland Mitigation Planning Study is to define planning criteria, evaluate project alternatives, and document the selected design for the Los Capitancillos Freshwater Wetland Mitigation Project (project). This study is also intended to meet the requirements of the California Environmental Quality Act and the Santa Clara County Water District Act. The Planning Study consists of an Engineers Report (Volume One), this document, and an Environmental Impact Report (Volume Two).

The Santa Clara Valley Water District's (District's) objective for the project is to construct by December 2002 at the Los Capitancillos site, wetland and wetland-associated riparian habitat that meets or exceeds 3.0 acres as proposed in the District Multi-Year Stream Maintenance Program of 2002 to a maximum of 4.5 acres. Specifically, the project will provide 0.6 acres of freshwater wetland mitigation required for the District's 1997 Urgent Sediment Removal Project and 1.9 acres for the year 2000 maintenance projects. Additional wetland acreage will be used to mitigate for anticipated future wetland impacts as described in the proposed Multi-Year Stream Maintenance Program (SCVWD 2002).

1.1 SCOPE OF PLANNING STUDY

The scope of the planning study is to evaluate alternatives and recommend a plan to create at least three acres of freshwater wetland habitat suitable for mitigation purposes on the Los Capitancillos site. A range of conceptual alternatives were developed and screened for suitability. Three wetland design configurations were advanced for consideration as project alternatives in the planning study. An alternative site was also considered for the purpose of the Environmental Impact Report. One of these alternatives was selected and developed as the proposed project.

1.2 PROJECT OBJECTIVES

The project objectives identified by the District for the Los Capitancillos Freshwater Wetland Mitigation Project are:

1. Construct by December 2002 at the Los Capitancillos site, wetland and riparian habitat that meets or exceeds 3.0 acres as proposed in the District Multi-year Stream Maintenance Program of 2002 to a maximum of 4.5 acres. Of the total wetland acreage constructed, use 2.5 acres to meet previous obligations for freshwater wetland compensatory mitigation (0.6 acres for the 1997 Urgent Sediment Removal Project and 1.9 acres for the Year 2000 Maintenance projects).

2. Identify additional site restoration or enhancement opportunities for District Board consideration.

1.3 PROJECT SITE

The Los Capitancillos site is located on a broad and relatively level floodplain terrace along the southern bank of Guadalupe Creek approximately 800 feet downstream from Masson Dam (Figure 1). Adjacent to the approximately 12.3-acre site, Guadalupe Creek bends northward. The project site is currently an open field comprised primarily of non-native grassland habitat situated on the south side of the Guadalupe Creek riparian corridor. The adjacent riparian corridor consists of scattered patches of mixed riparian habitat dominated by mature California sycamore (*Platanus racemosa*) rooted primarily at the top of bank. Previous studies in the vicinity of the project site indicate that channel erosion and incision have reduced the frequency with which flood flows in Guadalupe Creek exceed the height of the channel banks and access the adjacent floodplain. Interaction between the project site and the adjacent creek, which may once have occurred as often as annually, now requires a significant flood event (SCVWD 2000).

Under a separate project, the District has completed a project to restore shaded riverine aquatic habitat on Guadalupe Creek, including the reach that is adjacent to the project site (SCVWD 2000).

1.4 OWNERSHIP STATUS

The Los Capitancillos property is currently owned by the District. The District has arranged for access to Pacific Gas and Electric power line easement on property owned by the District. The purpose of the access is for the permanent placement of excavated soil from construction of the wetland. Current vehicle and maintenance access to the lines and power towers would be unchanged; the easement may see additional recreational use for bird watching in the constructed wetland. No additional right of way or property acquisition is necessary for this project.

1.5 REPORT ORGANIZATION

This report documents the development of the proposed Los Capitancillos Freshwater Wetland Mitigation Project. Chapter 2 identifies the Planning Criteria used to screen conceptual options for the wetland, and describes their genesis. Chapter 3 describes the application of the Planning Criteria to the conceptual options, the resulting advancement of selected options for consideration as design alternatives, and the justification for selection of the preferred alternative. The description of how the proposed project will meet project objectives and address identified constraints is provided in Chapter 4. In Chapter 5, the preferred alternative is developed as the proposed project to the preliminary design level. Chapter 6 describes the preliminary plan for operations and maintenance for the proposed project. The preparers of this report are documented in Chapter 7.

A number of technical appendices follow the main body of the document that report on supporting data collection and analyses conducted in the preparation of the proposed project. Finally, a set of the construction plans for the preliminary design (30% complete) is provided at the end of this document.

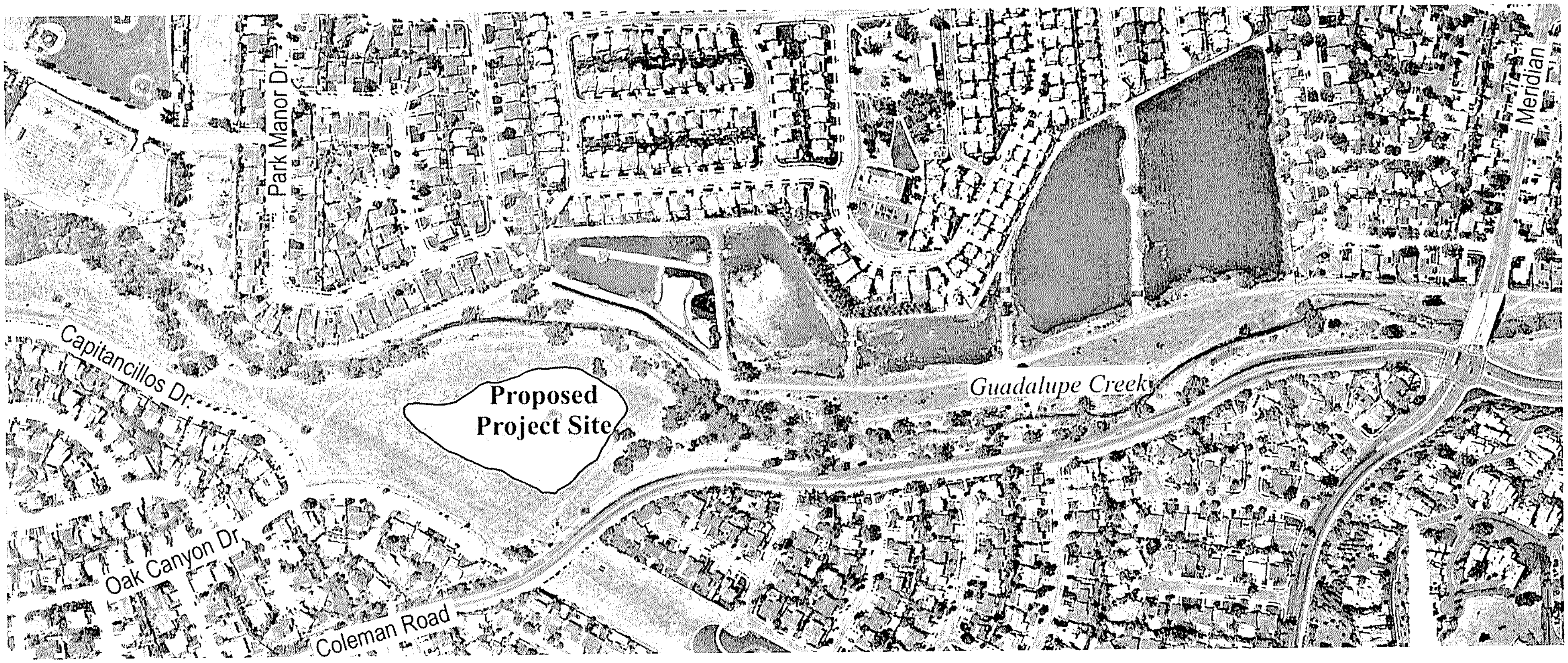


figure 1

Los Capitancillos Project Site

Proj # 1426 Loc Map 4-10-02.cdr

PWA

2. PROJECT PLANNING CRITERIA

In this Chapter, project objectives, site characteristics, and District Board Governance Policies are identified and described for the purpose of developing planning criteria. Planning criteria are defined as criteria that must be met by the selected project to accommodate project goals and objectives, site constraints, and other project requirements identified in the planning process.

2.1 PROJECT REQUIREMENTS FOR DISTRICT BOARD GOVERNANCE POLICIES

The project objectives identified by the District for the Los Capitancillos Freshwater Wetland Mitigation Project are defined in Section 1.2. The District has also identified the following District Board Governance Policies to be applicable to this Project:

Policy E-1, Article 2.1.1 states "Healthy creek and bay ecosystems are protected, enhanced, or restored as determined appropriate by the Board."

Article 2.1.1.3 states "Mitigation, enhancements or restorations are implemented when determined appropriate by the Board."

Policy E-1, Article 1.2 states "There is a reduced potential for flood damages."

Article 1.2.1 states "The cost of reducing the potential for flood damages is balanced with benefits (including possible environmental restoration and enhancement)."

Policy E-1, Article 2.2 states "There are additional open spaces, trails, and parks along creeks and in the watersheds when reasonable and appropriate."

Policy EL-1.1, Article 5 states the CEO/GM shall not "Fail to establish with consumers a clear understanding of what may be expected and what may not be expected from the service offered."

The following are District requirements for satisfying the Board Governance Policies listed above:

1. Provide substantial public input in the planning of the wetland area.
2. Identify possible public access opportunities for District Board consideration that are complementary to and consistent with the freshwater wetland.
3. Minimize impacts to the community and environment during construction and operation of the wetland.

4. Ensure compatibility of the freshwater wetland design with the Guadalupe Creek Restoration Project.

5. Ensure that operation of the wetland is feasible.

2.2 SITE CHARACTERISTICS

It is important to understand site characteristics and identify potential project constraints to ensure that the project will produce a sustainable wetland that meets the project objectives and District requirements. Site characteristics and project constraints are described below.

2.2.1 Water Source

In keeping with the overall project objectives, the water supply should be sufficient to support at least 3 acres of new freshwater wetland habitat. The proximity of the project site to Guadalupe Creek makes the creek a possible source of water to sustain a wetland at the site. However, due to the presence of mercury-containing sediments in the Guadalupe Creek drainage and concerns about the potential for mercury methylation in a wetland system, the creek is not desirable as a water supply source for the wetland.

Groundwater was also considered as a possible water supply source for the wetland. Groundwater levels were monitored from May 2000 to August 2001 as part of the Los Capitancillos project, and the results are provided in Appendix A. The average depth to groundwater for the three monitoring wells was 9.1 to 9.5 feet below ground surface, or at approximately the elevation of the creek water surface. If the wetland bottom extends below the level of the local groundwater table, it will not be possible to fully drain it. If the wetland bottom is close to the groundwater table, it may drain only slowly.

Groundwater is not a desirable source for water supply due to 1) the potential for mercury content in groundwater combined with concerns regarding the potential for the mercury methylation in a wetland system, and 2) the depth to the groundwater table, which would require significant excavation for a groundwater-dependent wetland.

The Almaden Valley pipeline owned and operated by the District was also identified as a possible water supply source. The pipeline lies at the southern property boundary of the project site and transfers raw untreated water from five possible sources past the project site to the Santa Teresa Water Treatment Plant. The primary source of water for the Almaden Valley pipeline is the San Luis Reservoir; other possible sources include: Anderson Reservoir, Calero Reservoir, Del Valle Reservoir (in Livermore), Almaden Reservoir, and the State Water Project's Banks Pumping Plant (in the Delta).

2.2.1.1 Water Usage

Water usage in the wetland will depend on percolation, evaporation, and precipitation at the project site, as well as the hydrologic regime identified for the wetland. Geotechnical investigations indicate that in-situ soils at the project site are highly permeable sands with gravel and cobbles, with potentially very high percolation rates (Appendix B). Lining the wetland with less-permeable materials than the native soils could reduce percolation, and therefore water use.

2.2.2 Hydraulics

The project site lies on the floodplain of Guadalupe Creek. Under a separate project, the District has completed a project to restore shaded riverine aquatic habitat on Guadalupe Creek adjacent to the Los Capitancillos project site. Restoration work completed on Guadalupe Creek included excavation of a lower elevation floodplain terrace at the Los Capitancillos site to increase the conveyance capacity of the existing channel as well as grading that separates the project site from the adjacent creek (SCVWD 2000). The ground elevation between the wetland site and Guadalupe Creek is now 1 foot higher than the estimated Guadalupe Creek 100-year water surface elevation. The new ground elevations will prevent creek flows from entering the Los Capitancillos project site except during extreme hydrologic events.

2.2.3 Water Quality

Maintaining (or improving) existing water quality is important for the success of the wetland project. Water quality parameters that are known to be important for the project and the adjacent Guadalupe Creek are temperature, pH, nutrients, dissolved oxygen, suspended sediments, and mercury.

Wetland waters will be warmed as a result of their detention on the site, and any outflow from the wetland has the potential to reach Guadalupe Creek. Potential thermal impacts from the wetland to the creek are an important constraint due to the temperature requirements for native anadromous fish species. Both steelhead rainbow trout (*Oncorhynchus mykiss*) and fall-run chinook salmon (*Oncorhynchus tshawytscha*) occur in the Guadalupe River system. The Guadalupe Creek Restoration Project is designed to create anadromous fish habitat on the creek, and temperatures in Guadalupe Creek should decrease over time as a result of the project. Outflows from the proposed wetland will be of concern if they increase temperatures in Guadalupe Creek above acceptable (suboptimal or optimal) levels for steelhead trout and fall-run chinook salmon.

Sediment flux between the project site and the adjacent creek is an important water quality consideration. To protect the water quality of Guadalupe Creek, the project should avoid contributing additional suspended sediment to the Creek. In addition, because mercury-containing sediments are known to be present in the Guadalupe Creek drainage and on the Los Capitancillos site, the delivery of sediment from the creek to the project site also is not desirable.

Nutrient levels in the Almaden Valley pipeline water based on available water quality data were evaluated as part of the eutrophication analysis presented in Appendix C, and determined to be suitable for wetland water supply. Almaden Valley pipeline water quality data provided by the District was also reviewed for mercury content. Mercury levels were below detection limits during the sampling time period (1999-2001).

2.2.4 Soils

H.T. Harvey & Associates (HTH) conducted a soils investigation to assess the site soil suitability for wetland habitat establishment (Appendix D). Soil texture and fertility were the primary features analyzed to determine the suitability of the in-situ soil. The soil profile was characterized in six test pits and soil fertility was assessed by laboratory analysis of composite soil samples. The results indicated that the subsoils (C horizons) were not suitable to support rapid establishment and high productivity of wetland vegetation due to their high rock and gravel content, low organic matter content and relatively high ratio of magnesium to potassium and calcium. Therefore, suitable soils for the establishment of wetland vegetation would need to be imported to the site in order to support wetland vegetation. Alternatively, it may be possible to amend existing site soils to enable the establishment of wetland vegetation.

2.2.4.1 Mercury

Mercury is present in the Guadalupe Creek watershed due to natural geologic conditions and was historically mined upstream of the project site. Most mercury found in and near the project site is attached to fine sediment or organic matter. The greatest concern associated with mercury is its conversion to dissolved or methylated forms that can be taken up by aquatic organisms. Mercury in the Los Capitancillos site soils is potentially of concern because wetland environments can support the biological methylation of mercury at the oxic/anoxic interface normally found near the wetland's soil surface. Because the optimum zone for mercury methylation in wetlands is the upper 4 inches of the soil surface, removing or burying mercury-bearing soils can prevent the formation of methyl mercury (Karen Summers, Tetra Tech, pers comm. 2000).

Soils within the proposed wetland footprint were sampled and analyzed for total mercury and extractable mercury (WET test). Soil mercury analysis results are presented in Appendix E. A total of 56 soil samples have been measured for mercury within the main Los Capitancillos area, and four additional samples to the north near the bank of the creek. The mercury concentrations in soil of the combined data set within the planned wetland area ranged from <0.02 to 15 mg/kg (wet weight). The mercury concentration threshold for soil to be classified for disposal as hazardous waste based on the TTLC (Toxic Threshold Limit Concentration), is 20 mg/kg (wet weight); thus, none of the samples tested would be classified as hazardous waste. For thirty samples at depths from 0 to 8 feet taken at six locations at the project site in November 2000, the average total mercury concentration among all samples was 1.75 mg/Kg (wet weight) and the total mercury concentration ranged from 0.17 to 15 mg/Kg (wet weight). Mercury concentrations were higher at the surface and decreased with depth. The total mercury concentrations averaged 3.85 mg/Kg (wet weight) for samples collected at the surface and 0.54 mg/Kg (wet weight) for samples collected at depth of 8 feet.

The second criterion for determining if a material is classified as a hazardous material is the STLC (Soluble Threshold Limit Concentration) limit of 0.2 mg/L. If the soil or other material is greater than ten times the STLC limit in units of mg/kg, i.e., 2 mg/kg for mercury, the Waste Extraction Test (WET) must be conducted. The WET leachate concentrations were measured on 36 samples from the planned wetland area. The mercury concentrations in all 36 samples were less than the STLC limit of 0.2 mg/L.

Both total and extractable mercury concentrations fell below hazardous waste concentrations for all soil sample locations and depths. Mercury concentrations at the levels found at the project site do not represent a human health hazard. Nonetheless, the total mercury concentration exceeded the SFRWQCB screening criteria for wetland cover soil at the majority of sample locations and depths. The San Francisco Regional Water Quality Control Board (SFRWQCB, 2000) draft screening criteria for wetland cover soil is 0.4 mg/kg (dry weight) (Appendix F).

2.2.5 Guadalupe Creek Restoration

Under a separate project, the District restored aquatic habitat on the reach of Guadalupe Creek that is adjacent to the Los Capitancillos site (in documents for the Guadalupe Creek Restoration Project, the site falls in what is referred to as Reach 4). Because of the close proximity of the two projects, the Los Capitancillos and Guadalupe Creek project teams worked together to balance the needs of the two projects and optimize the creation of mitigation habitat.

The Guadalupe Creek Restoration Project design for Reach 4 at the project site included excavation of a floodplain to increase the conveyance capacity of the existing channel. This excavation encroached on the Los Capitancillos site, which reduced the area available for wetland mitigation. As a result of coordination between the Los Capitancillos and Guadalupe Creek project teams, the limit of grading for Reach 4 preserves sufficient space on the Los Capitancillos site to construct a wetland at least 3 acres in area.

The Guadalupe Creek Restoration Project planted riparian vegetation and constructed aquatic habitat features along Guadalupe Creek and adjacent to the Los Capitancillos site. The wetland design should limit impacts to riparian habitat along Guadalupe Creek, and be compatible with the limits of grading agreed upon with the Guadalupe Creek Restoration Project.

2.2.6 Land Use and Easements

The project site has been owned by the District since the early 1970s and is currently an open field. It is designated *Public Park/Open Space* in the City of San Jose's 2020 General Plan. This designation is applied to lands that are publicly owned, though in some instances, public access may be restricted. These lands are devoted to open space use for the most part; although some development, such as restrooms, playgrounds, educational/visitor centers, and parking areas, are an inherent part of many of the properties so designated. The District has posted No trespassing signs on the site for several years.

A set of PG&E power lines pass over the southern side of the site in an east-west orientation. PG&E holds a 165-foot wide tower line easement on the site along the power line alignment. In addition, the underground Almaden Valley water supply pipeline passes through the same area of the site, and has a 30-foot wide associated easement held by the District. A 20-foot wide storm drain easement extends across the southwestern portion of the site. The potential extent of excavation on the site will be limited by the easements associated with the power lines, pipeline, and storm drain. In addition, a setback will be required from the Coleman Road embankment on the eastern boundary of the site.

2.2.7 Special Status Species

According to reconnaissance-level studies performed by HTH, construction of the wetland mitigation site has the potential to impact the following special status wildlife: breeding raptors including Burrowing Owls (*Athene cunicularia*), breeding migratory birds, salmonids, California red-legged frog (*Rana aurora draytonii*), and western pond turtle (*Clemmys marmorata*). Pre-construction wildlife surveys will determine whether measures will be necessary to avoid impacts to special status wildlife during construction of the wetland. Potential effects and mitigation measures for special status wildlife are described in the project's Environmental Impact Report (see Volume Two).

Red-legged frogs are particularly susceptible to predation by bullfrogs, a non-native species. The wetland should be designed to limit colonization by non-native bullfrogs.

2.2.8 Operation, Maintenance and Access

District personnel or sub-contractors will operate and maintain the wetland. The wetland design must be sustainable and adaptable to changing conditions and new information obtained in the course of its operation. The wetland design should include access for operation and maintenance personnel.

Creation of a wetland at the site will provide an attractive destination for local residents to engage in recreational walking and similar passive recreation activities. The City of San Jose staff is conducting a trails master planning effort and is evaluating an early conceptual option of a proposed regional trail passing near the site along the alignment of Guadalupe Creek. Although plans are not specific, it is likely that the trail will pass along the north side of the creek and away from the proposed wetland. Nevertheless, it can be anticipated that there will be some public pressure to use the site.

In keeping with the District requirements, the project could provide limited recreational access to the public, targeted to local residents only. Limited public access could include a nature trail, access to one or two viewing areas, and/or interpretive signage. The following design constraints regarding public access were developed through public and interagency meetings:

- No public access will be provided to the mitigation habitat area.
- People walking their dogs should be restricted from entering the mitigation habitat area.
- Use of the site will be targeted to local residents. No additional parking will be provided at the site, and there will not be signage along Oak Canyon Place pointing to the site.

2.2.9 Potential Nuisances

Given the proximity of the wetland site to a residential neighborhood, the project design must limit the potential for nuisances associated with the wetland such as mosquitoes and odors associated with the process of eutrophication.

The Santa Clara County Vector Control (SCCVC) will provide mosquito abatement services at the Los Capitancillos site as part of routine countywide procedures. SCCVC personnel provided the following wetland design recommendations to minimize mosquito colonization and abundance (Tietze, SCCVC, pers. comm. 2001):

- Provide a relatively simple design of the wetland edge.
- Limit emergent vegetation to less than 40% of total wetland area, including the expected area of natural colonization.
- Maximize areas of open water with depths of at least 4 feet to increase wind fetch.
- Ensure that the pond drains completely with minimal shallow puddles.

These vector control recommendations should be incorporated into the wetland design to the extent consistent with other project requirements.

2.3 PLANNING CRITERIA

Based on the project objectives, site characteristics, District Board Governance Policies and requirements, and project constraints, the following Planning Criteria have been identified for the Los Capitancillos Freshwater Wetland Mitigation Project:

1. The wetland design will create 3 – 4.5 acres of new freshwater wetland habitat and will identify other restoration and enhancement opportunities. .

2. Preference will be given to wetland designs that provide high potential habitat value (e.g. habitat diversity), in order to improve the likelihood that the project will be accepted by regulatory agencies as wetland mitigation.

3. The project will identify public access opportunities for limited recreational uses such as walking and bird watching and be of value to the community.

4. The project will meet the December 2002 construction deadline.

5. The wetland design will minimize nuisances associated with mosquitoes, algae, odors, and anaerobic conditions.

6. The wetland design and operation will minimize opportunities for bullfrog reproduction.

7. The wetland design and operation will minimize outflow of wetland waters into Guadalupe Creek to limit potential thermal impacts to the creek.

8. The wetland design will minimize the potential for mercury methylation.

These Planning Criteria were used to evaluate Conceptual Options and to choose Alternatives, as described in Chapter 3.

3. EVALUATION OF ALTERNATIVES

A broad range of conceptual design options were evaluated, as summarized in Table 1. Based on this evaluation, the three alternatives described below were selected for further consideration as they represent a range of alternatives that meet the project objectives and the planning criteria identified for the project, as described in Section 2.3.

3.1 CONCEPTUAL OPTIONS

The project team identified eleven potential conceptual options by combining elements related to water source, hydrologic regime, wetland depth and design, and public access level. A description of each of the design elements is provided below.

3.1.1 Wetland Depth and Design

The design of a wetland can take a variety of physical forms. Basic wetland designs considered in the conceptual option analysis included: single pond, multiple ponds, deep open water, shallow open water, and no open water.

3.1.2 Hydrologic Regime

Hydrologic regime determines the habitat mosaic a particular wetland design can support. Three potential hydrologic regimes were considered in the conceptual option analysis: seasonal, near-perennial, and perennial. A seasonal wetland would contain ponded water from November-December through April-May. A near-perennial wetland would contain ponded water for most of the year, but would dry completely for at least 2 weeks per year. A perennial wetland would contain ponded water throughout the year.

3.1.3 Water Source

Water supply is a key parameter in developing a successful wetland design. Three potential sources of water supply were considered in the conceptual option analysis: Guadalupe Creek, the Almaden Valley pipeline, and groundwater.

3.1.4 Public Access

One of the District requirements for the project is to identify possible public access opportunities for District Board consideration that are complementary to and consistent with the freshwater wetland. Significant and limited public access options were considered in the conceptual option analysis. "Significant access" was defined as including parking, trail, signage, and viewing areas. "Limited access" was defined as including only an unpaved trail, signage, and viewing areas (two or fewer). Significant public access would reduce the habitat value of any design option that was selected, while limited access would meet the access objective without significantly reducing habitat value. Therefore, it was determined that only project alternatives with limited public access would be considered.

3.2 ALTERNATIVES

Eleven conceptual options based on design elements, as well as the No Action and Alternative Location options, were developed:

Alternative A	No Action
Alternative B	Alternative Location
Alternative C	Large, Single Pond, Near-Perennial
Alternative D	As "C" but Perennial
Alternative E	As "C" but Smaller
Alternative F	As "C" but Multiple Ponds
Alternative G	As "C" but Seasonal
Alternative H	As "C" but Shallow
Alternative I	As "C" but No/Less Open Water
Alternative J	As "C" but Lower Elevation; Groundwater Water Source
Alternative K	As "C" but Groundwater Water Source (pumped)
Alternative L	As "C" but Creek Water Source (pumped)
Alternative M	Floodplain Water Source (creek flood flows)

Each of these conceptual options was evaluated against the planning criteria outlined in Section 2.3. Relative cost of the conceptual options was also considered in the evaluation. Table 1 presents the matrix that was used to evaluate the conceptual options. Options A, B, D, F, and I through M were eliminated from consideration due to failure to meet one or more of the planning criteria as indicated in Table 1. The remaining Options, C, E, G, and H, met the project planning criteria. As shown on Table 1, the evaluation of Option H is very similar to Option G but with somewhat higher cost and potential nuisance impacts. Option H, the shallow near-perennial wetland, was therefore eliminated from further consideration in favor of Option G, the seasonal wetland. Thus, Options C, E, and G were selected as the preferred alternatives for evaluation. Options C, E, and G, identified as Alternatives 1, 2 and 3 respectively, are discussed in further detail below.

For each of these Alternatives, an estimate of probable cost was developed. These cost estimates are very preliminary, and intended to allow comparison of the costs of the alternatives in a relative sense. Several assumptions were made to allow cost estimates to be derived; these assumptions are described in Appendix G, which provides the details of each cost estimate. The cost estimate will be refined for the selected project as it advances through the final design stage.

3.2.1 Alternative 1 - Large, Near-Perennial Wetland

Alternative 1 is identified as Option C in Table 1. It consists of a near-perennial wetland of the maximum size that can be accommodated on the site (3.5 – 4.5 acres of wetland mitigation habitat). The wetland would be designed as a single pond with shallow side slopes and a maximum depth of approximately 7 feet below ground surface. The near-perennial hydrologic regime would allow for ponding of the site for the majority of the year. A near-perennial wetland would support diverse habitat types including open water, tall emergent marsh, wetland ecotone, and riparian habitat. Oak woodland and grassland habitats could also be created on the upland portions of the site under any wetland alternative.

This alternative assumes that the source of water for the wetland is the Almaden Valley pipeline. Water levels in the wetland would be controlled throughout the year by manually operated or automated inlet and outlet works.

The potential mercury, thermal, nuisance, and bullfrog impacts could be controlled through project design and management. Mercury-containing soils could be buried to reduce the hazard of mercury methylation. Thermal impacts could be limited by decreasing wetland detention time, managing outflow rates and timing, and/or relying on percolation for needed outflows instead of outflow to the creek. Mosquito reproduction could be limited by designing the geometry and planting of the wetland to create disturbance of the water surface through wind action over most of the ponded water. The flow-through rate at the wetland could also be adaptively managed to limit mosquitoes and algae growth. If required, chemical or biological controls might also be employed for this purpose. Draining the wetland in early fall such that the surface soils were not ponded for at least 2 weeks would limit bullfrog reproduction at the site.

This option provides the highest potential mitigation acreage and habitat value in the form of habitat diversity of the options considered. Potential bullfrog, mercury, thermal, and nuisance impacts of this alternative could be minimized through design, operation and maintenance requirements. The estimate of probable cost for Alternative 1 is $3,180,000.

Table 1. Los Capitancillow Fresh Water Wetland Mitigation Project - Comparison of Conceptual Design Alternatives

Option	Wetland Mitigation Acreage	Habitat Value	Bullfrog Reproduction	Mercury Impacts	Thermal Impacts	Public Access to the Los Capitancillos Site	Nuisances at the Los Capitancillos Site	December 2002 Construction Deadline	Cost
	Goal: Maximum Area; Minimum Req: 3 acres	*Wildlife Diversity*	*Bullfrog Reproduction Potential*	*Potential for Mercury Methylation*	*Potential for Warming Guadalupe Creek*	*Provides Limited Public Access?*	*Risk of mosquitos, algae, odors*	*Could Meet Construction Deadline?*	*Relative Cost (low-mod-high)*
A. No Action	0 acres	Low	None	None	None	Current Access	None	No	Low
B. Alternative Location	At least 3 acres	Depends on Site and Design	Depends on Site and Design	Depends on Site and Design	Depends on Site and Design	Current Access	None	No	Depends on Site and Design
C. Large, Single Pond, Near-Perennial	3.5 - 4.5 acres	High	Low	Low	Low	Yes	Moderate	Yes	Moderate
D. As "C" but Perennial	3.5 - 4.5 acres	High	High	Low	Low	Yes	Moderate	Yes	Moderate
E. As "C" but Smaller	3.0 - 3.5 acres	High	Low	Low	Low	Yes	Moderate	Yes	Moderate
F. As "C" but Multiple Ponds	3.5 - 4.5 acres	High	Low	Low	Low	Yes	High	Yes	Moderate - High
G. As "C" but Seasonal	3.5 - 4.5 acres	Moderate	Low	Low	Low	Yes	Low	Yes	Low
H. As "C" but Shallow	3.5 - 4.5 acres	Moderate	Low	Low	Low	Yes	High	Yes	Low - Moderate
I. As "C" but No/Less Open Water	3.5 - 4.5 acres	Moderate	Low	Low	Low	Yes	High	Yes	Moderate
J. As "C" but Lower Elevation; Groundwater Water Source	<3.5 acres	High	High	Moderate - High	Low	Yes	Moderate	Yes	High
K. As "C" but Groundwater Water Source (pumped)	3.5 - 4.5 acres	High	Low	Moderate	Low	Yes	Moderate	Yes	High
L. As "C" but Creek Water Source (pumped)	3.5 - 4.5 acres	Moderate	Low	High	Low	Yes	Moderate	Yes	Moderate - High
M. Floodplain Water Source (creek flood flows)	>4.5 acres	Moderate - High	Low	Moderate	Low	Yes	Low	Yes	Moderate - High

shading indicates failure to meet project planning criteria

3.2.2 Alternative 2 – Smaller, Near-Perennial Wetland

Alternative 2 is identified as Option E on Table 1. It consists of a smaller (3.0 – 3.5 acres), near-perennial wetland on the Los Capitancillos site with a similar habitat mix and operational requirements to Alternative 1. The smaller wetland alternative provides less opportunity for District mitigation credit as compared to Alternative 1. The habitat types of this Alternative would be generally the same as in Alternative 1 but smaller, due to the smaller wetland acreage. Bullfrog, mercury and nuisance impacts are similar to Alternative 1. Thermal impacts may be similar to those of Alternative 1 due to the smaller volume of water held by the wetland. The estimate of probable cost for Alternative 2 is $2,600,000.

3.2.3 Alternative 3 - Seasonal Wetland

Alternative 3 is identified as Option G on Table 1. The seasonal wetland alternative would call for ponding of the site from approximately November-December through April-May. Similar to Alternatives 1 and 2, water levels in the wetland would be controlled by inlet and outlet works during the wet season. However, the wetland would be allowed to dry out during Spring and Summer, somewhat reducing the operational requirements as compared to the near-perennial alternatives. The seasonal hydrologic regime would support seasonal open water and short emergent marsh habitats. As with Alternatives 1 and 2, oak woodland and grassland habitats could be created in the upland areas.

Like Alternative 1, this alternative could provide the maximum mitigation acreage on the site. However, because of the shorter duration of ponding in the wetland, the diversity of habitat types would be lower than with the near-perennial alternative and aesthetic value is also expected to be lower, and may reduce the wetland's perceived value to the local community. A seasonal wetland would not support a breeding bullfrog population. The time period available for mercury methylation and mosquito reproduction would be shorter than for Alternatives 1 and 2, due to the shorter duration of ponding. However, a seasonal wetland is also less likely to sustain a large open water component over time, eliminating primary mosquito management strategies that require large areas of ponded open water. The potential for algae formation will be lower, given the elimination of ponding during warmer seasons. The potential for the nuisances of mosquitoes, algae, and odors are therefore likely to be somewhat lower than the potential under Alternative 1 or 2. As with Alternatives 1 and 2, mercury impacts could be minimized through design requirements. The potential for thermal impacts from a seasonal wetland are low. The estimate of probable cost for Alternative 3 is $1,960,000.

3.3 SELECTED ALTERNATIVE

The three alternatives described above were considered against the planning criteria (presented in Section 2.3) derived from the project objectives, site characteristics, and District policies and requirements to select the preferred alternative. Alternative 1 (Option C from Table 1) and Alternative 3 (Option G from Table 1) both had the potential to provide the largest areas for wetland mitigation credit on the site, identified by the District as a primary project objective. Alternative 3 was discounted, however, because of the lesser aesthetic appeal and lesser potential habitat value and diversity of a seasonal wetland as compared to the near-perennial alternative. Thus, Alternative 1 was selected since it offers an appealing visual aesthetic to the local neighborhood, has the potential for high habitat value and diversity, and provides the greatest potential mitigation credit for the District. As a result of this selection process, the remainder of the Planning Study will refer to Alternative 1 as the proposed project.

Current funding of $4,248,319 is available and budgeted to the project from Fund 22 West Valley Watershed Fund. About $700,000 is available as carry forward to the project from Fund 12 Watershed and Stream Stewardship Fund. An allocation formula will be developed for the Lower Peninsula Watershed, Guadalupe Watershed, Coyote Watershed, and Stream Stewardship fund to reimburse the West Valley Watershed for their share of the project costs.

4. PROPOSED PROJECT

A summary description of the proposed project is provided below, followed by a discussion of the proposed wetland design's approach to meeting project objectives and addressing project constraints. Chapter 5 then presents a description of the project elements at the preliminary design level.

The proposed project consists of a near-perennial freshwater wetland of the maximum size that can be accommodated on the Los Capitancillos site within the constraints of the project. The project will provide approximately 3.7 – 4.4 acres of wetland mitigation credit. The current wetland grading and planting plans described in this document are for a project that will supply 3.7 acres of wetland mitigation credit, comprised of approximately 3.0 acres of open water and emergent marsh habitat and 0.7 acres of wetland-associated riparian habitat. It is expected that it will be possible to revise the grading plan during the final design process to create a slightly larger wetland and associated mitigation credit, though the total acreage will be 4.4 acres or less. All target habitats, percentages for ponded water habitats, and other project features would remain as presented in this document.

The wetland is designed as a single pond with shallow side slopes and a maximum depth of approximately 7 feet below ground surface, surrounded by a riparian zone. The wetland and riparian areas will be over-excavated and backfilled with a layer of clean wetland cover soil. The Almaden Valley pipeline will provide the wetland water supply. The wetland will contain ponded water for the majority of the year, but will be drained in early fall such that the surface soils are not ponded for at least 2 weeks.

The project includes two elements designed to manage outflows from the wetland in addition to the percolation through the wetland bottom. First, the outflow swale between the pond and Guadalupe Creek is designed to percolate any outflows related to regular wetland operation, including drawdown of the wetland, before they reach the creek. Second, a network of percolation drains will be installed under the wetland soil cover to allow percolation of additional outflows as needed. These redundant drainage features are designed to prevent surface outflows from the wetland from reaching Guadalupe Creek except during extreme hydrologic events or emergencies, thereby minimizing thermal impacts to Guadalupe Creek. Flooding of the wetland by Guadalupe Creek is not expected except in extreme hydrologic conditions; as a result of grading completed for the Guadalupe Creek project, the ground elevation between the wetland site and Guadalupe Creek is now 1 foot higher than the estimated Guadalupe Creek 100-year water surface elevation.

The project includes some vegetation planting along the outflow swale and a limited public access component that are not necessary to the mitigation requirements of the project. These discretionary elements are considered enhancement opportunities subject to approval by the District Board of Directors, but are considered part of the proposed project in all descriptions of the project and its effects.

Enhancement opportunities as presented to the District Board in this planning study differ from the usual practice of first requesting the District Board for direction to pursue planning of enhancement features prior to incorporating those enhancement features into the CEQA planning process. In this case, the Board is being requested to adopt the enhancement features as part of the EIR or deny enhancement features by not adopting the enhancement parts of the project. The enhancement features, as described in this document, consist of limited public access facilities and the additional oak/willow riparian habitat along the outlet swale in the eastern portion of the site that is not required to meet project mitigation requirements.

4.1 WETLAND CONFIGURATION

The near-perennial wetland is designed as a single pond with shallow side slopes and a relatively simple edge (Plan Sheets 3 and 4). This geometry was selected for its ability to provide vegetated wetland habitat while minimizing mosquito abundance, consistent with advice from the Santa Clara County Vector Control District staff, by providing a large open water area (associated with a low percentage of pond colonized by emergent vegetation) and few areas of water that would be protected from wind.

In plan view, the wetland shape resembles a right triangle with the hypotenuse approximately parallel to Guadalupe Creek. The inlet works are located at the western corner of the wetland, and the outlet is along the eastern side (Plan Sheet 3). The bottom of the pond slopes gradually from west to east, with the deepest portion (approximately 7 feet below ground surface) adjacent to the outlet works. The pond will be graded to depths appropriate to support tall emergent marsh vegetation at its perimeter, and riparian vegetation will be planted around the pond in a zone up to 20 feet wide (Plan Sheet 16). During construction, both the pond and the riparian area will be over-excavated and backfilled with a layer of clean wetland cover soil. As part of the final design, upland areas will be graded so that potential storm water runoff from upland areas is directed away from the wetland. Nest boxes for mosquito-consuming swallows and bats will be constructed on the site.

4.2 TARGET HABITAT MOSAIC

The target habitats include a mosaic of open water (including both shallow and deep areas), tall emergent marsh dominated by tules (*Scirpus* spp.) and cattails (*Typha* spp.), and riparian habitat dominated by willows (*Salix* spp.) and Fremont cottonwood (*Populus fremontii*). The open water and tall emergent marsh will occur within the wetland (ponded areas), while the riparian habitat will be located around the outer perimeter of the wetland and the terminal pool of the outlet swale system. Revegetation including oaks and willows is proposed along the outlet swale[1] as an enhancement measure, subject to approval by the District Board of Directors. Table 2 shows the relative percentage of target habitat types and associated water depths. Relative percentages may change over time as the wetland matures. The target habitat mosaic meets regulatory agency wetland mitigation requirements, as discussed at the Interagency Meeting on September 12, 2001 at which the project was presented.

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[1] Approximately 15 oaks will be planted along the outlet swale to provide mitigation for removal of existing trees on the project site. Six hundred square feet of willow between Guadalupe Creek and the terminal pool of the outlet swale system will also be planted to provide mitigation for the area within Fish and Game jurisdiction that will be affected by excavation and placement of rock at the terminal pool. Neither of these project-required mitigation elements would constitute any part of the freshwater wetland mitigation area.

Table 2. Target Mitigation Area Habitat Mosaic

Habitat Type	Target Mitigation Area (Acres)	Approximate Percent of Ponded Area (%)	Approximate Percent of Mitigation Area (%)	Water Depth Range (feet)
Deeper Open Water	1.8	60	49	2.5-6
Shallow Open Water	0.5	17	14	1.5-2.5
Tall Emergent Marsh	0.7	23	19	0-1.5
Riparian	0.7	0	19	0
Outflow Swale Area (oaks and willows)	0.0	0	0	0
TOTAL	3.7			

The tall emergent marsh will be planted in the shallowly-flooded margin at the perimeter of the wetland. Areas of shallow and deeper water at depths of 1.5 to 6.0 feet will remain unplanted, though the shallower portions of the unplanted zone may be colonized by tall emergent vegetation over time. Vegetation in the tall emergent marsh will be dominated by California bulrush (*Scirpus californicus*), common tule (*Scirpus acutus*), narrow-leaved cattail (*Typha angustifolia*) and broad-leaved cattail (*Typha latifolia*). California bulrush, common tule and three-square (*Scirpus americanus*) will be planted, while cattails should establish rapidly via natural recruitment from wind-dispersed seed. Active planting of California bulrush, common tule, and three-square will accelerate the establishment of these species and help prevent the development of monotypic cattail stands.

The wetland ecotone will consist of a narrow band located between the tall emergent marsh and the riparian habitat. It will be planted with equal parts of California aster (*Aster chilensis*), western goldenrod (*Euthamia occidentalis*), smartweed (*Polygonum punctatum*) and bur reed (*Sparganium eurycarpum*).

The riparian habitat will consist of red willow (*Salix laevigata*), arroyo willow (*Salix lasiolepis*) and Fremont cottonwood (*Populus fremontii*) planted immediately adjacent to the upper edge of the emergent marsh at the water's edge. The shrub and herbaceous component of the riparian planting zone will consist of California blackberry (*Rubus ursinus*), mugwort (*Artemisia douglasiana*), snowberry (*Symphoricarpos albus* var. *laevigatus*) and creeping wild rye (*Leymus triticoides*).

The riparian habitat will include the installation of large woody debris to increase the structural diversity of this habitat. Three California black walnuts (*Juglans californica* var. *hindsii*) within the wetland excavation footprint will be removed with the root wads (i.e., the majority of the root mass within a 3-foot radius of the soil surface) intact prior to site grading. The root wad, trunk, and branches greater than 6 inches in diameter will be salvaged and stockpiled on site. After the completion of grading (soil excavation and soil cover placement), the salvaged large woody debris will be installed in the riparian zone. Portions of the large woody debris will be partially buried to a depth of approximately 6 inches. The outflow swale planting zone will be dominated by valley oak (*Quercus lobata*) and red willow, but will also include California buckeye (*Aesculus californica*) and blue elderberry (*Sambucus mexicana*).

4.3 HYDROLOGIC REGIME

The near-perennial wetland will contain ponded water for the majority of the year. The entire site will be drained in late summer (September) such that the wetland does not contain ponded water for at least 2 weeks. Target water levels and the drawdown schedule are shown in Figure 2. The mitigation site is intended to reflect the natural habitat and environment of wetlands in Santa Clara Valley, and the District may not be able to supply water to the mitigation wetland during natural drought periods. Failure to maintain target water levels could result in early senescence and/or mortality of wetland and riparian-associated vegetation.

The following project planning criteria guided the development of the hydrologic regime:

- minimize opportunities for bullfrog reproduction,
- support the project's target habitat mosaic,
- minimize outflow of wetland waters into Guadalupe Creek, thereby minimizing the potential for thermal impacts,
- minimize the potential for mercury methylation, and
- minimize potential nuisances associated with mosquitoes, algae, and odors.

The following sections summarize how the proposed project's hydrologic regime supports the planning criteria outlined above. Other design features that support these and other planning criteria are described elsewhere in this report.

4.3.1 Minimize bullfrog reproduction

The bullfrog (*Rana catesbeiana*) is a non-native species that would have a negative effect on the abundance and diversity of wildlife species (e.g. waterfowl, songbirds, small mammals, amphibians) inhabiting the wetland mitigation site. In addition, although bullfrogs are likely present in the adjacent percolation ponds and creek, colonization of a breeding population at the mitigation site would increase bullfrog numbers in the general area. Therefore, the water management of the site has been designed to avoid the creation of bullfrog breeding habitat. Pipeline inflows will be turned off at the beginning of September to allow water levels to recede gradually through September, supplemented as necessary using the wetland outflow percolation systems, such that there is no ponded water in the wetland for at least 2 weeks. The 2-week period with no ponding will kill bullfrog larvae and thus prevent successful bullfrog reproduction. The timing of the drawdown is intended to reduce the likelihood of rainfall during the drawdown period, while also reducing stress to wetland and riparian vegetation as described below.

In addition to accomplishing the primary objective of preventing bullfrog reproduction, the annual drawdown will also provide foraging habitat for fall migrating shorebirds.

4.3.2 Support target habitat mosaic

The near-perennial hydrologic regime is designed to support a mosaic of open water (including both shallow and deep areas), emergent marsh, wetland ecotone and riparian habitat. The annual drawdown will occur in fall when evaporation and transpiration rates are lower than in the summer, and plant metabolism is beginning to slow down. Lower evaporation and transpiration rates in fall will help conserve residual soil moisture in the rooting zone during the drawdown. To prevent die-off of tall emergent vegetation, the entire drawdown period, including the period in which the surface soils are not ponded, will last no longer than 8 weeks. Adaptive management of the hydrologic regime can be used to modify the drawdown timing and/or duration if the recommended schedule cause stress on vegetation (Chapter 6).

4.3.3 Minimize outflows to Guadalupe Creek

The wetland is designed to prevent surface outflows from the wetland from reaching Guadalupe Creek except during large storms or emergencies to minimize the potential for thermal impacts on the creek's aquatic habitat. Both the inlet and outlet works will be adjustable to allow adaptive management of water levels.

During routine operations, inflows to the wetland from the Almaden Valley Pipeline will continually replace water lost to evaporation and percolation in order to maintain the target water level without generating outflows to the creek. During the rainy season, particularly when large storm events are expected, water levels should be lowered by 0.5 feet to provide additional storage for storm water runoff and reduce the potential for storm-related outflows to Guadalupe Creek.

During the annual drawdown, the inlet will be shut off and water levels will be allowed to recede gradually via evaporation and percolation. If needed, the outflow swale between the wetland and Guadalupe Creek can be used to percolate additional water to accelerate drawdown. In addition, a network of percolation drains will be installed under the wetland soil cover to supplement percolation if needed (Chapter 5).

4.3.4 Minimize potential for mercury methylation

Water will be supplied to the wetland via a connection to the District's Almaden Valley water supply pipeline near the western end of the site. The use of pipeline water instead of creek overflows helps minimize the potential for mercury methylation by avoiding the introduction of mercury-contaminated water and/or sediment from Guadalupe Creek to the wetland. In addition, as a result of grading completed for the Guadalupe Creek project, the ground elevation between the wetland site and Guadalupe Creek is now 1 foot higher than the estimated Guadalupe Creek 100-year water surface elevation. The new ground elevations will prevent creek flows from entering the project site except during extreme hydrologic events.

During final design, site grading will be planned so that storm water runoff from upland areas surrounding the wetland is directed away from the wetland. This strategy will minimize the potential for eroded soils to reach the wetland though surface runoff, and to thereby limit the contribution of mercury-containing sediment from upland areas to the wetland.

4.3.5 Minimize Mosquitoes, algae, and odors

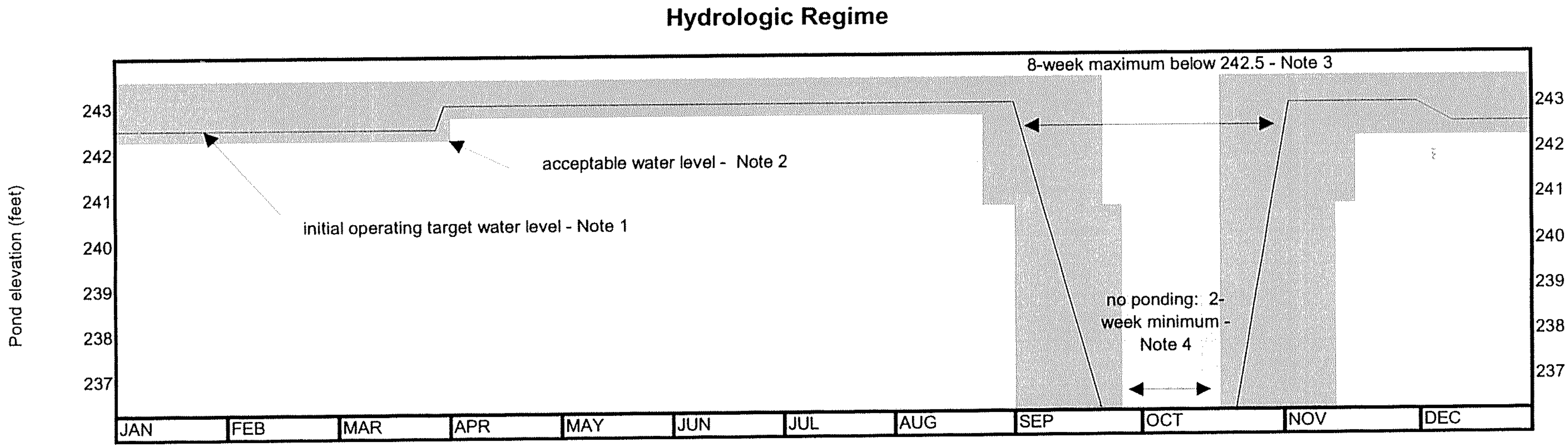
Mosquitoes

Santa Clara County Vector Control District personnel provided guidance on the design of the wetland to minimize mosquito colonization and abundance. The hydrologic regime is consistent with their guidance and contributes to minimization of mosquito populations by:

1) draining the pond completely during drawdown, with minimal shallow puddles, and;
2) providing for adaptive management of water levels and flow-through to increase water circulation if needed.

Algae and odors

Eutrophication is the process whereby aquatic ecosystem primary production (especially of algae) increases to a point in which the water column becomes hypoxic (low dissolved oxygen concentrations) due to bacterial decomposition of decaying macroalgae and phytoplankton. This process can cause foul odors. The eutrophication potential of the proposed project was analyzed based on expected inflow rates, nutrient and dissolved oxygen concentrations for Almaden Valley pipeline, residence time, and drawdown timing (Appendix C). This analysis concluded that, although some algae formation may occur, the system should function as a healthy wetland pond and nuisances such as foul odors should be negligible. The annual drawdown will help minimize eutrophication by annually oxygenating the wetland soil surface. In addition, adaptive management of water levels and flow-through could be used to increase water circulation and thereby reduce eutrophication, if needed.



Notes:

1. The line indicates a target water level for the first year's operation, including a 0.5 rainy season drawdown from December - March. Actual target water levels may differ, as experience is gained in the operation of the wetland. This is a principle of adaptive management.
2. The shaded area indicates the range of acceptable water levels throughout the year, subject to the indicated constraints.
3. To limit stress on emergent vegetation, the maximum period of time for the water level to be below 242.5 should not exceed 8 weeks. Actual experience may trigger adaptive management changes in the length of this period; stress may begin earlier, especially in hotter periods. It may also be possible to keep the water level lower, longer, but this can only be assured through observation and experience.
   Lowered water levels will provide foraging habitat for migrating birds.
4. To limit bullfrog reproduction, a period of "no ponding" within the wetland of at least 2 weeks should occur.

figure 2

Hydrologic Regime

Proj. # 1426 HydoR.cdr PWA

5. PRELIMINARY DESIGN

This chapter provides descriptions of major design elements of the proposed project, including wetland excavation, soil cover, inlet and outlet works, planting, and public access. Engineering plans for the preliminary design (30% complete) are included at the end of this report.

5.1 WETLAND CONSTRUCTION

The wetland will be excavated to up to 8 feet below existing ground surface (for a 7-foot deep wetland with 1 foot of soil cover), requiring approximately 33,000 cubic yards of excavation. Existing soils, including a layer of lean clays 2- to 3-feet thick located just below existing ground surface (see Appendix B) will be removed from the footprint of the wetland and adjacent riparian areas. During construction, the wetland and adjacent riparian areas will be over-excavated and backfilled with a layer of wetland cover soil (Plan Sheets 3 and 4). As part of the final design, the grading plan will be refined to show that upland areas surrounding the wetland will be graded to drain away from the wetland.

5.1.1 Soil Management

Construction of the wetland will generate approximately 33,000 cubic yards of excess material. Although onsite soils are not acceptable as wetland cover due to mercury concentrations, virtually all of the excavated material (all soils with less than 20 mg/kg of mercury) will be eligible for reuse onsite in upland areas, outside of the wetland limits (see Section 2.2.4.1). However, because the wetland was designed to maximize use of the site, there are limited upland areas where excess material can be placed. It appears that approximately 9,000 cubic yards of excavated material can be placed on upland areas onsite, assuming that fill can be placed within Pacific, Gas & Electric's (PG&E) 165-foot wide easement.

The remainder of excavated material that is not placed onsite will need to be transported and disposed offsite. The total volume of soil disposed of offsite would range from approximately 24,000 to 33,000 cubic yards, depending on whether soil can be placed in the PG&E easement. During construction, excavated material will be sampled and analyzed in accordance with a project-specific Soil Management Plan to confirm the final disposal location(s) (see Section 5.7). Based on existing soil sampling results, it is assumed that a significant volume would have to be disposed offsite at a Class II facility due to mercury concentrations. It is possible that for some volume of soil, the mercury concentrations may be low enough to allow less costly disposal at a Class III landfill. Based on existing soil sampling results, chemical and metal concentrations are not anticipated to exceed hazardous levels requiring disposal at a Class I facility as hazardous waste.

5.1.2 Wetland Soil Cover

As described in other sections, the constructed wetland will be over-excavated and backfilled with a layer of imported wetland soil. This soil cover will separate the active zone of mercury methylation from the mercury in the in-situ subsoils, and provide a suitable growing medium for emergent wetland vegetation and benthic invertebrates. In addition, soil cover will have lower permeability than native soils, to limit percolation from the wetland, improving the site's capacity to retain water. Soil cover specifications needed to meet the requirements of the project are presented in Appendix F.

The soil cover will be placed in the wetland and in surrounding riparian areas. The required thickness of wetland soil varies with habitat type. The wetland soil cover should be thick enough to:

- Provide adequate depth for emergent wetland plant growth and freshwater benthic invertebrate establishment;
- Minimize the potential for assimilation of in-situ mercury from the subsoil by wetland plant roots and benthic invertebrates; and
- Minimize the potential for methylation of mercury in the existing subsoil.

For emergent marsh habitat, the majority of root biomass associated with the target wetland species typically occurs in the upper 12 inches of soil. Therefore, an 18-inch thick layer is recommended for emergent marsh and shallow open water habitats, providing a 6-inch buffer for differential settlement. Soil cover will be extended to the riparian planting zone to minimize the potential for methylation during occasional periods of inundation, and to prevent contribution of mercury-containing sediment to the wetland from the riparian zone via erosion. For simplicity of construction and to remove any lean clays located just below existing ground surface, the 18-inch soil cover is extended throughout the riparian zone, though a shallower soil cover of 6 to 12 inches would provide adequate protection from potential mercury impacts.

For deep open water habitat, target benthic invertebrates are expected to include oligochaetes (aquatic earthworms) and insects, particularly dipteran (e.g. flies and midges) larvae. These subsurface deposit feeding and burrowing species generally occur within the upper 4 inches of sediment (Sinicrope, Scripps, pers. comm. 2000; Ganz, Univ. of CA Davis, pers. comm. 2001). Therefore, a 12-inch thick layer of wetland soil should provide a sufficient factor of safety for deep open water areas.

The entire footprint of the wetland will be excavated to the design excavation grade or lower to provide an excavation surface with a total mercury concentration below one mg/kg. If necessary, in-situ subsoils with total mercury concentrations above one mg/kg will be over-excavated and backfilled to design excavation grades with soils that have total mercury concentrations below one mg/kg.

The optimum zone for mercury methylation in wetlands is typically the upper 4 inches of the wetland soil where redox potentials are intermediate between oxic and anoxic conditions (Summers, Tetra Tech, pers.

comm. 2001). Consequently, the specified soil cover thickness of 18 and 12 inches separate the active zone of mercury methylation from the mercury in the in-situ subsoils and thereby preclude methylation of mercury in the subsoils.

5.1.3 Erosion Protection

A wind wave analysis for the wetland indicate that wind fetch produced by the anticipated maximum average wind speed may disturb the soil cover to a depth of 0.25 feet, and higher wind speeds may disturb the soil cover to a depth of 1 foot. (See Appendix H for results of wind wave analysis.) Emergent marsh, wetland ecotone, and riparian vegetation planted around the perimeter of the wetland will protect the soil cover from potential erosion due to wind waves.

During final design, the site grading plan will be refined to ensure that storm water runoff from upland areas is directed away from the wetland to reduce the potential of erosion from surface runoff and transport of mercury-containing sediment from upland areas.

Additional erosion protection at the inlet and outlet will be included in the final design to protect the soil cover from erosion during refilling of the wetland after the annual drawdown period. The final design will likely include the grading of a swale in the bottom of the wetland to direct flows during refilling. This swale will be reinforced to resist erosion of the soil liner using cobbles, erosion control fabric or other suitable measures to be defined during final design.

5.2 INLET WORKS

The inlet works for the proposed wetland provide a connection from the Almaden Valley pipeline near the western end of the site to the wetland. The inlet works consists of piped connection to the Almaden Valley pipeline that connects to an inlet vault and discharges to an inflow channel to the wetland. The inlet piping controls consist of valves and level controls coupled with a remote telemetry unit (RTU) to control inflow rates based on water levels in the wetland. The inlet works also includes a turn out for connection of the irrigation system (Plan Sheets 6 and 7). The inlet channel will be a series of rock step pools to give the inlet channel a natural creek-like feel, provide energy dissipation, and increase dissolved oxygen levels in the inflow (Plan Sheets 8 and 9).

5.2.1 Design Flow Rate

A design flow rate from the Almaden Valley pipeline was established to design the components of the inlet works. The design flow rate is the estimated flow rate required to refill the wetland within 2 weeks after the annual drawdown period. The data presented in Appendix I demonstrate the wide range of potential liner permeability rates and resulting percolation volumes. For the purpose of determining a maximum design inflow rate, the following assumptions were made:

- Zero precipitation for the month
- Maximum evaporation rate for September from the 40-year record (September 1977)
- Maximum percolation rate measured at the Los Capitancillos percolation ponds

- Soil voids above the groundwater table are unsaturated before filling
- Soil voids above are completely saturated after filling
- A safety factor of 2

The design inflow rate was based on a one-month water balance computed for refill period:

Inflow = Factor of Safety x (Evaporation + Void Volume + Percolation + Wetland Volume)

The design inflow rate computed was approximately 4 cubic feet per second (cfs) (approximately 1800 gpm). The average inflow rate to maintain the water level in the wetland during the remainder of the year (November to August) was approximately 0.4 cfs.

5.2.2 Connection to Almaden Valley Pipeline

Water for the wetland will be transferred from the existing Almaden Valley pipeline that is located south of the wetland. The Almaden pipeline consists of a 66-inch diameter reinforced concrete pipe (RCP) operating at pressures averaging approximately 105 pounds per square inch (psi). The Almaden Valley pipeline transfers raw untreated water from five sources to the Santa Teresa Water Treatment Plant. The District will design the pipeline point of connection.

5.2.3 Inlet Piping, Valves and Level Control

The inlet works will consist of the following components housed in a concrete vault:

- Steel piping (8-, 12- and 18-inch) to and from the inlet vault
- Pressure reducing valve assembly
- Flow meter
- Shut-off valves
- Control panel
- Connection for irrigation system

Depending on the final analysis of the system, the pressure reducing valve assembly will consist of a sleeve valve or a rotary valve. The design flow rates for the system range from 0 to 4 cfs, with an average expected flow of approximately 0.4 cfs. The expected average pressure in the Almaden Valley pipeline is 105 psi. The high and low pressures will need to be determined for final design. The outlet pressure at the outlet headworks is assumed to be zero to 5 psi. For the pressure drop of up to 100 psi, a sleeve or rotary valve is required. If required, sound attenuation within the vault (e.g., using insulating panels or a double wall construction) will be provided as part of the final design.

The pressure-reducing valve will be automatically controlled to vary the flow rate into the wetland based upon the water level in the wetland. An ultrasonic level transducer in the wetland will measure the water level. The flow meter in the inlet vault will measure the flow rate from the pipeline. Both of these devices will transmit a signal to the programmable logic controller (PLC) and RTU in the control panel near the PRV vault. The PLC will use both signals to control the valve to obtain the desired flow rate. Float switches can be also be installed in the wetland as back up for the level transducer. The RTU can be connected to a central telephone auto-dialer or radio to send emergency low and high water level alarms and/or provide local indicators if desired.

A schematic of the inlet piping with all of the components has been included in the attached Preliminary Design Engineering Plans. Table 3 summarizes recommendations for the hardware to be used for the inlet piping.

Table 3. Inlet Piping Hardware

Description	Manufacturer	Size	Quantity
Gate Valve	Mueller	12 inch	2
Magnetic Flowmeter	Rosemount	8 inch	1
Sleeve Valve	Bailey/Lindsey	8 inch	1
Rotary Valve	Caltrol-Fisher	8 inch	
Valve Actuator	Limitorque/Auma/EIM		
Steel Pipe		18 inch	20 linear feet +/-
Steel Pipe		12 inch	155 linear feet +/-
Steel Pipe		8 inch	25 linear feet +/-
HDPE/PVC Pipe		2 inch	
Ball Valve	Hayward/ASAHI	2 inch	1
Irrigation PRV	CLA-VAL	2 inch	1

5.2.4 Energy Dissipation

The inlet works are designed to deliver up to 4 cfs to the wetland. The wetland inlet vault will be connected to a reinforced concrete headwall at the inlet channel via a 12-inch diameter pipe. The increased pipe size will reduce flow velocities at the outlet to a non-erosive level. At the peak inflow rate of 4 cfs into the wetland, the water will exit the 12-inch diameter pipe at 5.1 feet per second. The step pools in the inlet channel, described below, will provide additional energy dissipation.

5.2.5 Inlet Channel

The inlet channel is designed to convey the design inflow rate of 4 cfs into the wetland. The inlet channel includes a series of step pools between the piping outlet and the wetland, which provide a total drop of approximately 4 feet. The step pools are designed as a series of drop structures incorporating large 1- to 2-ton rocks. The step pools will provide aeration and energy dissipation of the inflow. The inlet channel will be lined with riparian vegetation.

5.3 OUTLET WORKS

The goal of the outflow system is to allow flexibility for adaptive management of the system based on operational experience and changing climatic and operational conditions. The outlet works will control outflows from the wetland during the annual drawdown and during extreme storm events, as well as any regular outflows related to operation and maintenance of the wetland.

The outlet works will consist of two separate yet complementary drainage system components. The primary outlet from the wetland is a gated outlet structure that connects to the outflow channel (Plan Sheet 10). The outlet structure will contain an adjustable v-notched weir that will allow wetland operators to fine tune water level and flow-through rates. The outlet weir will empty into an outflow channel designed to allow the flows to infiltrate prior to reaching Guadalupe Creek. A terminal pool on the Guadalupe Creek floodplain will provide a transition from the outflow channel to the creek and a checkpoint to assess the appropriateness of outflow rates (Plan Sheets 12-15).

A secondary outlet system, designed as a percolation network, is provided to supplement infiltration in the outflow channel during the drawdown period. The percolation network consists of a perforated riser connected to two percolation drains located under the riparian habitat surrounding the wetland and a percolation drain located under the outflow channel for use when the wetland level drops below the elevation of the outlet weir. The percolation network is designed to further limit outflows to Guadalupe Creek during the drawdown period.

The outlet structure and the perforated riser will be located at the eastern boundary, closest to the deepest area of the wetland. The wetland also includes an emergency spillway that will provide a flow path for overflows from the wetland that may occur during an extreme storm event. A National Pollutant Discharge Elimination System permit or waiver of Waste Discharge Requirements may be required by the RWQCB for outflow from the wetland into the creek that may occur during large storm events.

5.3.1 Design Outflow Rates

The outlet weir structure will be designed to convey two design flow rates: a higher flow rate related to storm-generated outflows, and a lower flow rate to allow a maintenance flow, should routine flow-through be desired.

To determine the higher design flow rate, 100-year peak outflow rates were estimated for the site's pre-project condition as an open field (Appendix J). The weir will be designed to control the post-project 100-year peak flow rate so that it is lower than the estimated pre-project flow and peak flows to Guadalupe Creek are not measurably increased over current levels. The computed peak flow rates for the site ranged from approximately 1.1 cfs for a 100-year 24-hour storm to approximately 2.0 cfs for a 100-year 6-hour storm. Therefore, the weir will be designed to convey 2 cfs with less than 0.5 feet of head.

The outlet swale system will be sized to achieve an infiltration rate sufficient to accommodate the maximum level of routine outflows, or the lower design flow rate. This percolation rate represents the highest outflow rate that the outlet swale system can accommodate without discharging flows to Guadalupe Creek. The design drawdown rate was estimated at 0.15 cfs for a 28-day drawdown period given the volume of water held by the wetland and the time period constraints established for the drawdown (Appendix K). The infiltration rate of the outlet swale is dependent on the wetted area and permeability of the outlet swale. The wetted area of the outlet swale was estimated to be approximately 7,000 square feet, including the percolation trench located below the swale and two areas for ponding before outflows reach Guadalupe Creek. The permeability of the in-situ soils in the vicinity of the outlet swale was conservatively assumed to be 2.85 feet/day based on previous geotechnical investigations (Appendix B). The total infiltration rate for the outlet swale was conservatively estimated to be approximately 0.23 cfs (approximately 103 gpm) (Appendix L).

5.3.2 Outlet Structure

The primary outlet from the wetland will be a weir-gated outlet structure that discharges to the outflow channel (Plan Sheet 10). The outlet structure includes a weir chamber connected to a 24-inch diameter reinforced concrete pipe (RCP). The weir chamber will be a 4-foot by 5-foot concrete vault with a wing-type headwall. The headwall includes a trash rack to avoid debris clogging the weir gate and to prevent unauthorized access. The downward-opening weir gate will be centered in the chamber. The weir gate has a 3-foot wide crest with a 6-inch deep v-notch to control low flow rates from the wetland. The crest of the weir gate will be manually adjustable between elevation 241.5 and 243.5 feet NGVD, which is consistent with target water levels (see Figure 2).

The weir crest is designed to convey a peak flow rate of 2 cfs, with a driving head less than 0.5 feet. The preliminary design of the outlet structure and weir gate was based on published guidelines (USBR). The weir gate will connect to a 24-inch diameter pipe that discharges to the outlet channel. A concrete headwall with trash rack will be installed at the pipe outlet to limit erosion and unauthorized access. The maximum discharge velocity from the outlet pipe is expected to be approximately 4 feet per second (ft/s) based on the peak flow rate of 2 cfs. The need for erosion protection at the outlet pipe will be evaluated during final design.

5.3.3 Outlet Channel

An outlet channel from the wetland to Guadalupe Creek will be graded at the eastern end of the site. The outlet channel is designed to allow infiltration of regular outflows from the wetland and provide a flow path for storm flows from the wetland. The outlet channel is designed to maximize infiltration, and consists of an infiltration trench, two infiltration pools and a terminal pool on the floodplain of Guadalupe Creek (Plan Sheets 12-15). The percolation capacity of the outlet channel, including the infiltration trench and two infiltration pools, was conservatively estimated to be 0.23 cfs (Appendix L).

Riparian and upland vegetation will be planted along the outlet channel (Plan Sheet 16). This vegetation will provide shade, reducing heat gain in wetland outflows, as well as uptake some water discharged from the wetland.

Grade control structures will be installed in portions of the outlet channel between infiltration pools where the channel slope is 1% or greater. The grade control structures will be designed to maintain a stable long-term channel by reducing erosion and down cutting. Grade control structures are currently designed as rock filled trenches supporting bio-technical engineering measures including willow and cottonwood plantings.

5.3.3.1 Infiltration Channel

The most upstream portion of the outlet channel is the infiltration channel, which connects the outlet pipe to the first infiltration pool. The infiltration channel will be backfilled with permeable drain rock to increase its infiltration capacity. The infiltration channel will also include a buried perforated pipe that connects to the percolation system (see Section 5.3.4). The perforated pipe will be placed in a 2-feet wide by 5-feet deep trench backfilled with drain rock.

5.3.3.2 Infiltration Pools

There are two infiltration pools along the outlet channel that will enhance infiltration and limit outflows to Guadalupe Creek. Each of the pools will be graded so that water can pond to approximately 3-feet deep before discharging downstream. The infiltration pools will be lined with sand, gravel, and/or cobbles to provide structural stability and enhance infiltration.

5.3.3.3 Guadalupe Creek Outfall

The proposed outfall to Guadalupe Creek includes a terminal pool on the floodplain terrace. Given the highly permeable nature of the sandy soils on the high flow terrace, routine flows to the outlet swale system are expected to percolate into the infiltration channel and pools and not reach the terminal pool. During large storm events, discharges to the terminal pool will be limited to the minimum necessary to prevent flooding of upland areas. Based on the hydrologic analysis presented in Appendix J, discharges to Guadalupe Creek are only expected during storm events larger than the 50-year, six-hour storm. During such storm events, the water surface in Guadalupe Creek will be above the floodplain terrace, mingling with wetland outflows in the terminal pool.

5.3.4 Percolation Network

A separate percolation network will be installed to supplement percolation and facilitate the complete drainage of the wetland during drawdown (Plan Sheet 10). The percolation trenches will provide redundancy to the drainage system; allow water from the annual drawdown of the wetland to be used by the riparian habitat located around the perimeter of the wetland; and will provide flexibility to deliver water for percolation to subsurface areas other than the outflow swale.

The percolation network consists of a perforated riser connected to an underground network of percolation drains. The riser will be an 18-inch diameter perforated pipe located in the low point of the wetland. The percolation network consists of three buried perforated pipes placed in trenches. Trenches will be located under the soil cover and the shallow lean clay layer below that cover will also be excavated and removed, as previously discussed. Based on available subsurface data for the site, it is not anticipated that the percolation trenches will intercept any clay lenses that will reduce the function of the percolation network below expected levels. The riser will be connected to each of the percolation pipes via valves that will enable operators to utilize one or more of the percolation pipes during the annual drawdown. One percolation trench is located below the invert of the infiltration channel (Section 5.3.3.1); the other two percolation trenches are located under the riparian habitat area surrounding the wetland.

The percolation capacity of the two percolation trenches located around the perimeter of the wetland was conservatively estimated to be 0.69 cfs (Appendix L). Combined with the percolation capacity of the outlet channel described above, the percolation network provides an extra level of flexibility and redundancy for draining the wetland during the annual drawdown (Appendix K).

5.3.5 Emergency Spillway

An emergency spillway will be constructed between the wetland and Guadalupe Creek. The emergency spillway is designed to convey a peak 100-year 0.25-hour flow rate of 10 cfs with a maximum 0.5-feet of driving head. The crest of the spillway is at elevation 244.0 feet NGVD, 1 foot above the target water surface of the wetland. The crest of the spillway is 20 feet wide and 1 foot deep. The side slopes of the crest section are designed at 10:1 (horizontal: vertical) to allow for vehicles to traverse the crest.

The emergency spillway will be constructed using an articulating concrete block (ACB) system. The ACB system is a series of interconnected concrete blocks designed to provide erosion protection for the emergency spillway. For the preliminary design, the blocks along the spillway crest are closed-cell and filled with gravel to facilitate discharge of the design flow and allow for vehicular access. Open-cell blocks (approximately 20% open area) are used on the upstream and downstream sides of the spillway to allow for some vegetation establishment. The blocks should be sized during final design of the spillway.

5.4 PLANTING PLAN

Plants will be installed in four planting zones; emergent marsh, wetland ecotone, riparian, and outflow channel (Plan Sheet 16). The outflow swale revegetation area is not part of the area claimed as mitigation. Table 4 provides guidelines for plant installation. The planting layout within each zone is discussed below. Adjustments to the planting palette, if required at the time of installation, will comprise local species native to the respective habitat types.

5.4.1 Emergent Marsh

The emergent marsh planting zone will be planted with common tule (*Scirpus acutus* var. *occidentalis*) and California bulrush (*Scirpus californicus*). An additional, much smaller component of the plantings may consist of three-square bulrush (*Scirpus americanus* var. *occidentalis*). The wetland mitigation plantings will be on 4-foot centers, using triangular spacing. The plants will likely be grouped in clusters of the same species. The three-square bulrush plantings will be located toward the shallower end of the wetland area. It is anticipated that cattails (*Typha* sp.) will establish rapidly on the wetland bench via natural recruitment from wind-dispersed seed. Active planting of the recommended emergent wetland plants will accelerate the establishment of those species and help prevent the development of monotypic cattail stands. Establishment of a diverse assemblage of wetland species will result in a greater diversity of wildlife species at the site.

5.4.2 Wetland Ecotone

The wetland ecotone planting zone will consist of a narrow band at the transition between the emergent marsh and the riparian habitat. It will be planted with equal parts of California aster (*Aster chilensis*), western goldenrod (*Euthamia occidentalis*), smartweed (*Polygonum punctatum*) and bur reed (*Sparganium eurycarpum*). The wetland ecotone plantings will be on 4-foot centers, using triangular spacing. The plants will be grouped in clusters of the same species. This planting zone will not have any true boundaries, but will instead provide a transition from the emergent marsh to the riparian habitat. The smartweed and bur reed plantings will be located closer to and partially within the emergent wetland, while the California aster and the western goldenrod plantings will be located closer to and partially within the riparian habitat.

5.4.3 Riparian

The riparian habitat will consist of a band (up to 20 feet wide) of red willow (*Salix laevigata*), arroyo willow (*Salix lasiolepis*) and Fremont cottonwood (*Populus fremontii*) planted around the perimeter of the wetland. The riparian habitat also includes a shrub and herbaceous component that will include California blackberry (*Rubus ursinus*), mugwort (*Artemisia douglasiana*), snowberry (*Symphoricarpos albus* var. *laevigatus*) and creeping wild rye. The riparian shrubs will be planted in 'clusters' of 5 to 8 planting basins of the same species. The riparian trees will be planted on 12- to 16-foot centers, and the shrubs and herbs will be planted on 8-foot centers (Table 4).

The seepage analysis presented in Appendix M predicts that the groundwater level will taper from the pond's edge to a depth of 8 to 9 feet below ground surface (existing groundwater level) at 100 feet away. This would put the groundwater level at approximately 3 to 5 feet below the ground level at the outer extent of the riparian planting zone, which is more than adequate for successful establishment of both willow and cottonwood trees. Any potential future decrease in seepage and in the resulting groundwater mounding around the pond is not likely to affect the successful establishment of riparian vegetation at this site. Any reduction in groundwater mounding would occur slowly, and tree roots would follow the receding groundwater table. Existing groundwater levels are within the depth range suitable for willows and cottonwoods, and the length and timing of the annual drawdown were designed to minimize stress on the riparian vegetation. Further, the percolation network facilitates irrigation to riparian habitat areas via subsurface flow during the annual drawdown.

The soil cover textural specifications for the riparian planting zone were designed to be comparable to the texture of the existing underlying soils (gravelly loam to gravelly sandy loam) (Appendix D). Therefore, the soil texture between the imported topsoil layer and the native underlying soil will be sufficiently similar to ensure normal root development.

Table 4. Los Capitancillos Freshwater Wetland Mitigation Site, Plant Installation Guidelines

Planting Zone	Common Name	Scientific Name	Approximate Percentage of Planting Zone	Average On-Center Spacing	Container Size*	Number of Plants Required
Emergent Marsh	common tule	*Scirpus acutus* var. *occidentalis*	45%	4 ft.	Treeband	1175
	California bulrush	*Scirpus californicus*	45%	4 ft.	Treeband	1175
	three-square bulrush	*Scirpus americanus*	10%	4 ft.	Treeband	261
Wetland Ecotone	California aster	*Aster chilensis*	25%	4 ft	1-gallon	102
	western goldenrod	*Euthamia occidentalis*	25%	4 ft	1-gallon	102
	Smartweed	*Polygonum punctatum*	25%	4 ft	Treeband	102
	Bur reed	*Sparganium eurycarpum*	25%	4 ft.	Treeband	102
Riparian (Tree Canopy)	Red willow	*Salix laevigata*	40%	12 ft.	Live cuttings	81
	arroyo willow	*Salix lasiolepis*	30%	12 ft.	Live cuttings	60
	Fremont cottonwood	*Populus fremontii*	30%	16 ft.	Live cuttings	60
Riparian (Shrubs And Herbaceous Layer)	California blackberry	*Rubus ursinus*	40%	8 ft.	Deepot	417**
	Snowberry	*Symphoricarpos albus* var. *laevigatus*	20%	8 ft.	Deepot	207**
	Mugwort	*Artemisia douglasiana*	10%	8 ft.	1-gallon	105**
	marsh baccharis	*Baccharis douglasii*	10%	8 ft.	Deepot	105**
	creeping wild rye	*Leymus triticoides*	20%	8 ft.	1-gallon	207**
Outflow Swale Planting Zone	valley oak	*Quercus lobata*	50%	18 ft.	Seeding/Treepot-4***	26
	blue elderberry	*Sambucus mexicana*	20%	12 ft.	Treepot-4	6
	California buckeye	*Aesculus californica*	10%	12 ft.	Seeding/Treepot-4***	6
	Red willow	*Salix laevigata*	40%	12 ft.	Live cuttings	47

*Container dimensions are as follows: 1-gallon: 6” x 6” or 6” x 7”; Treepot-4: 4” sq x 14” long (1 gallon Treepot); Deepot: 2½” sq x 10” long Treeband: 2¼” sq x 5” deep; Live cuttings: 18” long x ½ to ¾” diameter, 1 cutting per planting site.

** Number includes 3 plants per basin

***Direct Seeding or Treepot-4. Direct seeding preferred, container stock is being grown as a contingency in case of poor acorn production or high buckeye seedling mortality.

5.4.4 Outflow Channel Planting Zone

Valley oaks (*Quercus lobata*) and red willow will dominate the outflow swale revegetation zone. Other species in this planting zone include California buckeye (*Aesculus californica*) and blue elderberry (*Sambucus mexicana*). Red willow will be planted at the terminal infiltration pool and between that pool and the creek.

5.4.5 Ordinance Tree Replacement Mitigation

Three ordinance-sized trees (California black walnuts) will be removed during wetland mitigation construction. These will be mitigated by the installation of 15 additional trees outside of the riparian habitat mitigation areas in the outflow swale revegetation area. For the tree removal mitigation requirements, please refer to the project's Environmental Impact Report (Volume Two).

5.4.6 Existing Plant Removal

All herbaceous vegetation within the planting zones will be treated with herbicide legally appropriate and after death will be cut to a maximum height of 2 inches and removed from the site.

5.4.7 Irrigation Installation

A bubbler irrigation system will be installed for the trees, shrubs, and creeping wild rye (*Leymus triticoides*) plantings in the riparian planting zone.

5.5 PLANT INSTALLATION

The District has already procured the tree and shrub species and container types specified in Table 4 for each respective planting zone under contract with Cornflower Farms. Cornflower Farms is propagating the plants from propagules of Guadalupe River watershed origin. Should any changes in plant species or numbers be required for project installation, additional propagules will comprise native species obtained from the Guadalupe or other Santa Clara County watershed. The container plants and cuttings (Table 4) will be installed between October and March. The cuttings will be installed in January or February once the trees are dormant.

5.5.1 Emergent Marsh Plant Installation

The wetland will be flooded to the target water surface elevation (approximately 243 feet NGVD) to completely saturate the soil cover and allow soil to settle. Pond water level will be decreased to the lower elevation edge of the emergent marsh planting zone during plant installation within the emergent marsh. This will help facilitate plant installation. After completion of plant installation within the emergent marsh planting zone, the pond water surface elevation will be raised as close to the target water level elevation (approximately 243 feet NGVD) as possible without completely submerging the top of the stems of the emergent marsh plants. If the water surface must be maintained below 243 feet to avoid submergence of the tops of the plant stems, the water surface will be raised to the target elevation of 243 feet in the following late spring after growth of the emergent plants.

5.5.2 Container Plants

Holes approximately 6-inches wide and 6-inches deep will be dug for the container plants in the emergent wetland and wetland ecotone planting zones. All wetland plants will be installed so that their root crowns are at the soil surface.

Holes approximately 1-foot wide and 2-feet deep will be dug for the tree and shrub container plants in the riparian and outflow swale planting zones. All stones greater than 3 inches in diameter will be removed from the excavated soils and replaced with native material or topsoil fill. Plants will be installed so that the roots are not restricted or distorted and their root crowns are at or slightly above (0.5 inches) the soil surface following planting, soil settlement, and initial irrigation. Trees and shrubs will be irrigated immediately following planting. Any plants that have settled deeper than indicated on the plans after initial irrigation shall be raised back to the required level. A 4-foot diameter irrigation basin will be constructed around each plant, and the irrigation basins will be surrounded by 6-inch high, 6-inch wide earthen berms. Irrigation basins will not be necessary for the wetland plantings.

Plants will be removed from the containers so that the ball of earth surrounding the roots is not broken, and planted immediately after removal from the container. Containers shall not be cut until just prior to plant installation.

5.5.3 Cuttings

Red and arroyo willow cuttings will be harvested from Guadalupe Creek adjacent to the site between December 15 to 31, 2002. Willow cuttings will be approximately 18-inches long and ½ to ¾ inch in diameter. Each cutting harvested will be examined and those with insect damage will be discarded. Cornflower Farms will deliver the Fremont cottonwood cuttings. Willow and cottonwood cuttings will be installed between December 15 to 31, 2002. The cuttings will be treated with rooting hormone immediately prior to installation to enhance rooting. They will be installed so that the lower two-thirds (2/3) of the cutting is buried. The cuttings will be installed immediately following harvesting and delivery, if possible. If stored, the cuttings will be placed in buckets of water in a cool, shady location between harvest and installation, and will be stored no longer than 48 hours.

5.5.4 Wood Chip Mulch

Wood chip mulch will be pneumatically applied to the riparian and outflow swale planting zones to control weeds and erosion. After plant, seed, and irrigation installation are complete, broad-scale wood mulch will be applied. Before mulch is applied, all live weeds situated inside plant basins will be hand pulled and live weeds outside planting basins anywhere within the project limits will be treated with herbicide legally appropriate for use in the area and, after death, be cut to 2 inches and removed. Wood mulch will then be applied with a pneumatic blower and an application hose. Wood mulch will be a continuous layer both inside and outside of planting basins. It will be uniformly 4 inches deep outside basins but be of graduated depth within the basins. An 8-inch diameter circle around each individual plant or seeding site will be cleared free of mulch to deter crown rot. Emitter and ¼ inch distribution lines shall be buried under wood mulch. If necessary, a nonphytotoxic tackifier will be used to keep the mulch in place on slopes.

5.5.5 Hydroseeding

Any newly graded areas outside of the planting zones will be hydroseeded. The seed mix will include a mix of native grasses and forbs that will benefit wildlife and be attractive for the adjacent residents. Seed will be mixed to ensure broadcast at the seed rates shown in Table 5. The relatively high seed application rates are recommended to both ensure good erosion protection and to increase the potential for the native hydroseeded species to persist in the longer term. Seed, fertilizer, wood fiber and tackifier will be applied with hydroseed equipment in a one step application using the following application rate: seed mix + wood fiber (800 lbs/acre) + fertilizer (300 lbs/acre of 6N – 20P –20K) + non-asphaltic tackifier (120 lbs/acre).

Table 5. Seed Specifications for seed of leguminous species

Scientific name*	Common name	Minimum percent purity	Minimum percent germination	Pounds pure live seed per acre
		Leguminous species		
Lupinus succulentus	Arroyo lupine	90	80	8
Lotus scoparius	Deerweed	90	70	2
Total				**10**
		Non-Leguminous species		
Bromus carinatus	California brome	95	80	25
Hordeum brachyantherum	Meadow barley	85	80	25
Vulpia microstachys	Three week fescue	90	80	8
Elymus glaucus	Blue wild rye	95	80	8
Eschscholzia californica	California poppy	90	70	4
Total				70

* San Francisco Bay Area ecotypes

Seed of all leguminous species (arroyo lupine and deerweed) will be pellet-inoculated in accordance with the provisions in Bulletin 1842, "Range-Legume Inoculation and Nitrogen Fixation by Root Nodule Bacteria" of the University of California, Division of Agriculture and Natural Resources. Legume seed will be pellet-inoculated at a rate of 5 times the amount recommended on the inoculant package. Legume seed will be sown within 90 days after inoculation or will be re-inoculated prior to hydroseeding. Inoculated legume seed will have a calcium carbonate coating.

5.5.6 Soil Amendments

Depending on the soil cover source identified for import to the site, the soils may require amendment to improve their fertility for plant establishment. Once the soil cover source is identified, it will be analyzed for horticultural suitability to determine if amendments are necessary.

5.5.7 Plant Protection

Based on observations from the District's Guadalupe Creek vegetation maintenance activities, deer browse does not appear to be a significant concern. However, all outflow swale and riparian plantings will be fitted with a root cage to protect them from gophers. An underground non-galvanized wire gopher cage will be installed on all riparian and outflow swale species during planting.

5.6 ACCESS

In accordance with the project planning criteria, the proposed project has identified public access opportunities for limited recreational uses such as walking and bird watching. Additionally, access to the inlet works, outlet works, and the perimeter of the wetland is provided for maintenance personnel.

5.6.1 Maintenance Access

Maintenance personnel will access the site through an existing gate on Oak Canyon Place. The proposed project includes a ten-foot wide maintenance road that will provide the following access:

1. Inlet Works – Access for maintenance personnel and vehicles to the valves and controls that regulate the flow of water into the wetland.
2. Outlet Works – Access for maintenance personnel, vehicles, and light equipment to the outlet works.
3. Vector Control – Access for vector control personnel along the perimeter of the wetland to facilitate the application of biological controls.

5.6.2 Public Access

Planning criteria for the project include the identification of public access opportunities for limited recreational uses such as walking and bird watching. Because public access is not required to meet the mitigation requirements of the project, the public access component is an optional feature and subject to approval by the District Board. The public access component of the recommended project is relatively limited and consists of the following elements: pathway, maintenance road, viewing platforms, and fencing (Plan Sheet 19).

The proposed project includes a ten-foot wide maintenance road that will start at existing maintenance gates adjacent to Oak Canyon Place. The road will extend from the gate to the inlet pools and to the eastern end of the wetland near the outlet works. The maintenance road will form the public access pathway on this portion of the site. The proposed project also includes a 4-foot wide path around the north side of the wetland, which links the maintenance road segments at the inlet and outlet works to form a looped trail around the entire wetland. The looped trail is included in the proposed project because most visitors are likely to prefer a looped trail rather than having to double-back on the same trail and, if there is no designated path, are likely to make their own trails throughout the northern side of the project site. Placement of the trail is consistent with City of San Jose guidelines, which recommend that public access trails be restricted from areas within 10 feet of a riparian zone.

The proposed project includes two viewing areas as part of the public access component. One viewing platform is near the outfall ponds because it is a visually attractive area, the platform can be comfortably integrated into the landscape, and there is some potential for interpretation near the wetland margin. A second viewing area at the inlet pond is also included. However, an exposed platform at this area may be too visually prominent in the adjacent open landscape and will be re-evaluated as part of the final design. The viewing area at the inlet ponds could be a paved area with benches and interpretive signs, where people could learn more about the wetland.

The proposed project includes a 42-inch high fence around the entire wetland to discourage access to the wetland by visitors and dogs. The fence will be blended with the upland shrub planting to reduce its visual impact. The fence design included in the preliminary plans is comprised of wooden posts and heavy-duty wire mesh with 6-inch openings.

5.7 BEST MANAGEMENT PRACTICES

Best Management Practices (BMPs) are practices or procedures that avoid, reduce or minimize a project's effect on various resources. Post-construction BMPs associated with long-term operation of the wetland are included as an integral part of the project design and operation requirements described in other sections of this report. Additional operations and maintenance BMPs will be included in the long-term operations and maintenance procedures that will be developed as part of final project design. Construction BMPs will be implemented during project construction to address specific construction effects. Standard District construction BMPs are included as Appendix N.

One specific construction BMP that will be developed during the final design is the Soil Management Plan. The Soil Management Plan will include protocols for testing and classifying excavated material for disposal. Prior to construction, the Soil Management Plan will be updated to reflect final project design and to incorporate input from the San Francisco Bay RWQCB regarding management of soils containing elevated mercury concentrations. The updated Soil Management Plan will be submitted to the RWQCB for approval prior to implementation.

The Soil Management Plan will include protocols for classifying excavated soils based on standard analytical tests used for the disposal of material at appropriately licensed disposal sites. It will also provide criteria for classification of material considered inert based on California's standard waste extraction test procedures, as well as procedures for disposal and reuse of these materials.

After stockpiling the material that cannot be reused onsite, sampling for metals, which are the main constituents of concern, will be conducted from each stockpile at the required frequency to meet landfill and RWQCB requirements (e.g., one four-part composite per 2,500 cubic yards of soil). Leaching tests using either the California Waste Extraction Test (WET) or the US EPA Toxic Characteristic Leaching Procedure (TCLP) procedures will be performed on samples where the total concentration of a given metal exceeds the criteria used to determine when these tests are needed to classify the material. Limited sampling for petroleum hydrocarbons and polynuclear aromatic hydrocarbons will be conducted of the material for disposal, since based on the previous sampling events, these compounds are not likely to be present at concentrations requiring disposal at Class I or Class II disposal sites. The laboratory results will be used to classify the soil pursuant to the criteria outlined in the approved Soil Management Plan.

6. MONITORING, OPERATIONS, AND MAINTENANCE

This chapter describes hydrologic and ecologic monitoring, operations, and maintenance procedures that are integral to meeting the project objectives. Long-term operations and maintenance of the wetland will be described in detail in a plan prepared as part of the final design.

6.1 HYDROLOGIC MONITORING AND MAINTENANCE

The proposed wetland design allows for adaptive management of hydrologic regime and vegetation health through adjustment of water levels, inflow rates, outflow rates, irrigation frequency and quantities, and annual drawdown timing. The following maintenance criteria will be used to determine if the hydrologic function of the wetland is operating as designed:

1) maintain target water levels within the acceptable water level range shown in Figure 2;
2) zero surface water discharge to Guadalupe Creek during drawdown;
3) during drawdown, meet the following constraints: ≥ 2 weeks with no ponded water, and no mortality of wetland and riparian vegetation during and after the drawdown.

6.1.1 Monitoring Hydrologic Parameters

District personnel will monitor and record hydrologic parameters on an ongoing basis, as part of routine wetland operation. The monitoring methodology and frequency defined below may be evaluated and adjusted by the District based on the experience gained during the 5-year monitoring period described in the Mitigation and Monitoring Plan (HTH 2002). Water level, discharge, drawdown timing, and water usage will be monitored as follows:

1. **Water levels** in the wetland will be monitored by recording water level readings both from the automated inlet works instrumentation and from a staff gage installed in the wetland. (*weekly*)

2. **Discharge** from the wetland will be monitored by
    - observing water level and extent in the outflow swale between the pond and Guadalupe Creek, and
    - recording the depth of water flowing over the V-notch weir.

   (*weekly* during normal operations, *three times weekly* during annual drawdown)

3. **Annual drawdown** timing and duration will be monitored by recording the dates on which:
    - each method of drawdown is initiated (e.g. inflows stopped, flows introduced to outflow swale, flows introduced to percolation network),
    - ponded water is **not** observed in the wetland (first observation),
    - re-filling of the wetland is initiated, and

- the target water level is achieved after refilling.

During the annual drawdown and re-filling of the wetland, water levels will be monitored by recording water level readings both from the automated inlet works instrumentation and from the staff gage. (*three times weekly* during annual drawdown and refilling)

4. **Water usage** will be monitored by recording readings of inflow rate from the automated inlet works instrumentation. This information will be used to calculate water losses from the wetland in order to plan the annual drawdown. (*weekly*)

6.1.2 Data analysis

District personnel will periodically review the hydrologic monitoring data collected. If data indicate that the wetland is not functioning properly, District personnel will initiate maintenance activities and/or adjustments as described in Section 6.1.3. Specifically, District personnel will examine the hydrologic monitoring data for the following:

1. If water levels read at the RTU begin to drift from those observed at the staff gage, the ultrasonic level transducer will need to be serviced.
2. Inflow rates and volumes will be used to estimate water usage (see Annual Drawdown in Section 6.1.1.). Estimates of water usage will be used to manage the annual drawdown.
3. If surface discharge to the terminal pool above Guadalupe Creek is observed, lowering the water level or raising the weir will decrease outflow rates over the v-notched weir.

6.1.3 Water Level Management

Based on the monitoring data collected, District personnel can fine-tune the hydrologic operation of the wetland by adjusting a variety of parameters, including water levels and outflow rates to the outflow swale and the percolation network.

6.1.3.1 Water Level Control

The automated inlet works will be programmed to maintain a target water level in the wetland by continually replacing any water lost to evaporation and percolation. However, during the rainy season, rainfall could raise the wetland water level above the target level and cause water to flow over the outlet weir. To minimize the potential for storm-related outflows, and to efficiently utilize pipeline water during the winter, the wetland should be operated with lower water levels throughout the rainy season or when a large storm is anticipated.

6.1.3.2 Inflow Rate Control

As described above, inflow rates will generally be controlled by percolation and evaporation rates in the wetland. In the event that flow-through rates need to be increased for adaptive management purposes, the outlet weir may be lowered and/or the water level increased to increase outflows from the wetland. This will, in turn, result in increased inflow rates to maintain the target water level.

6.1.3.3 Outflow Rate Control

In the event that outflow rates need to be decreased to avoid discharges to Guadalupe Creek, the outlet weir may be raised and/or the target water level may be lowered.

6.1.3.4 Annual Drawdown

Pipeline inflows will be turned off in early September to allow water levels to recede gradually via infiltration and evaporation by October, such that the surface soils have no areas of ponding for a minimum of 2 weeks. To prevent die off of tall emergent vegetation, the entire drawdown period, including the 2-week period in which the surface soils are dry, should last no longer than 8 weeks. The pond will be refilled to the target water surface elevation by late October.

Wetland operators will analyze water usage data to determine the water loss rate (percolation and evaporation) for the wetland prior to the beginning of the drawdown period. If loss rates are such that the wetland will not drain within 4 weeks, operators will discharge water to the infiltration pools to accelerate the drawdown period. The outlet weir may be lowered in intervals to drain up to two feet of water (5.14 ac-ft) from the wetland into the infiltration pools at the start of the drawdown process. Operators will exercise care not to lower the outlet weir to the point that water is discharged to Guadalupe Creek.

If discharge over the outlet weir will not sufficiently accelerate the drawdown period, operators will discharge water to the percolation network. The percolation network can be accessed at any point during the drawdown process to accelerate wetland drawdown.

6.2 ECOLOGIC MONITORING AND MAINTENANCE

Annual monitoring of the mitigation site by a qualified biologist during the initial years of habitat establishment will determine if the project has met its mitigation obligation. Attainment of the performance criteria outlined in the Mitigation and Monitoring Plan (HTH 2002) will indicate that the mitigation site is well on its way towards meeting the long-term habitat goals with little chance of failure.

The Los Capitancillos mitigation site will initially be monitored over a 5-year period. The monitoring parameters to be utilized to determine target functions and values of the mitigation site and to assess site stability are presented in detail in the Mitigation and Monitoring Plan. By the final year of monitoring, the site should be sufficiently well established to determine if it will eventually achieve the long-term goals. The results of the final year of monitoring will be compared to the performance criteria to determine if they have been met. If the performance criteria of the mitigation project have not been met, monitoring will continue until they have been achieved.

6.2.1 Maintenance of Vegetation

Maintenance of the hydrologic regime will ensure the long-term establishment and survival of the vegetation. The riparian and outflow swale plantings will be maintained via weed control and irrigation at regular intervals for the first three (3) years. After Year 3, little to no vegetation maintenance is expected to be required. Routine maintenance of the emergent marsh will not be required.

Monitoring data will be used to evaluate the success of the mitigation site. Information from this monitoring program will be used to direct necessary maintenance to ensure the success of the mitigation site.

6.2.2 Emergent Marsh

Site grading, soil cover placement, planting and management of the hydrologic regime in accordance with this plan will result in rapid establishment of native, tall emergent wetland species. Routine maintenance of the emergent marsh vegetation will not be required during normal operation of the wetland.

6.2.3 Riparian and Outflow Swale Habitats

Maintenance of plantings in riparian areas and the outflow swale is expected to include plant replacement, irrigation, and weed control.

6.2.3.1 Dead Plant Replacement

Dead plants will be replaced during the 3-year maintenance period (HTH 2002). Replacement plants will use the same installation methods used for installation (see Section 5.5). The plant species chosen for replacement will be based upon a critical evaluation of the vigor and growth of the plantings installed. Those species that are well adapted to the plantings sites and are rapidly establishing will generally be used to replace dead plants. However, if a qualified biologist determines that plant density/competition appears to be detrimental to site development, the District may recommend not replacing dead plants. Additionally, it may even recommend the culling of individual plants to improve the long-term viability of the site.

6.2.3.2 Irrigation

All trees, shrubs, and creeping wild rye will be irrigated via a bubbler irrigation system during the 3-year maintenance period. Irrigation shall be administered so that the plants do not show any visible signs of drought stress, and will be gradually tapered throughout the maintenance period. In Year 1, the plantings will be irrigated approximately 2-4 times per month from March through October. Each watering will provide a significant amount of water to encourage the development of taproots. The irrigation schedule in Year 2 will be based on the water requirements of the plants and is anticipated to be lower (approximately 1-2 times per month), while in Year 3, little irrigation (0-1 time per month) will be required. The irrigation schedule may be modified to ensure vigorous plant growth during the summer months and/or times of drought.

The irrigation system should be regularly maintained during the 3-year plant establishment period. Any component of the system not functioning properly will be subsequently repaired as part of regular site maintenance. The maintenance contract should include a provision that the irrigation system will be continuously checked and kept in working order. During the months when irrigation is required, maintain the earthen berms as needed around each tree and shrub to ensure that the irrigation basins hold all water applied and retain the appropriate dimensions.

6.2.3.3 Weed Control

Weeds within the restoration site will be controlled around each plant and throughout the site as a whole during the first 3 years of the monitoring period. The irrigation basin around each installed tree and shrub will be kept weed free by maintaining a 3-inch thick wood chip mulch layer and manually removing the weeds that become established in the mulch. Weeds throughout the riparian and outflow swale habitat areas will be kept to a maximum height of 1 foot year round using a mower and/or "weed eater" or by spraying with an herbicide. Weed control activities will occur before seed set.

6.2.3.4 Natural Recruitment

Care will be taken to avoid damaging naturally recruiting native tree and shrub seedlings during maintenance activities. Maintenance personnel will be trained to differentiate between native and non-native species. Fostering natural recruitment will aid in rapid habitat development.

6.2.4 Maintenance of Nest Boxes

Swallow nest boxes should be cleaned each year during the drawdown with a mild (<10%) bleach solution to prevent viral and bacterial diseases and contents removed to prevent build-up of mites and other parasites. This should be done as long as the nest boxes remain at the site. No maintenance will be needed for the bat condominium, but any bat boxes on site should be cleared of all cobwebs and/or wasp nests in the winter for the first 2 to 3 years (non-occupancy times). Nest boxes should be inspected 1 to 2 times per year during the nesting season so that non-native species can be evicted and occupancy rates can be measured.

6.2.5 Vector Control

The Santa Clara County Vector Control District has broad authority for the control of disease vectors and pests. They have responsibility to both inspect public and private lands for suspected sources of disease vectors and pests and to abate those sources when found with physical, chemical, or biological control measures. The Vector Control District will exercise their responsibilities for vector control at the project site on an as-needed basis. The proposed project's design has been formulated in consultation with their staff to assure prudent design with respect to minimizing mosquito populations and adequate access for their staff should abatement measures be required.

7. LIST OF PREPARERS

This report was prepared by the following PWA staff:

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8. LIST OF REFERENCES

H.T. Harvey & Associates. 2002. *Santa Clara Valley Water District 1997 and 2000 Stream Maintenance Projects Nontidal Wetland Mitigation and Monitoring Plan* (*Los Capitancillos Wetland Mitigation Site).*

Santa Clara Valley Water District (SCVWD). 2000. *Guadalupe Creek Restoration Project from Almaden Expressway to Masson Dam: Engineer's Report and Draft Environmental Impact Report/ Environmental Impact Statement.*

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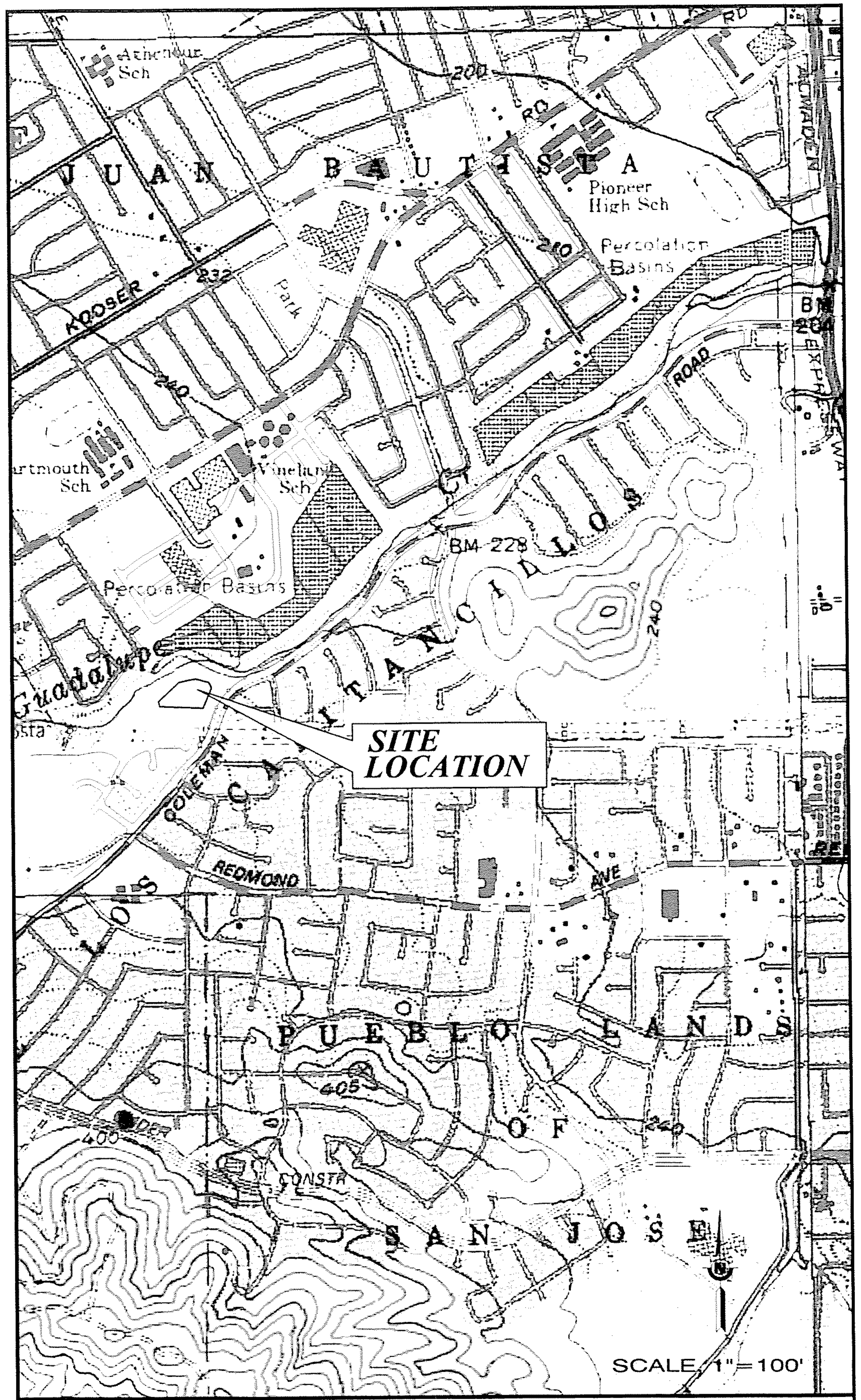
San Francisco Bay Regional Water Quality Control Board (SFRWQCB), 2000. *Beneficial Reuse of Dredged Materials: Sediment Screening and Testing Guidelines* (draft staff report), May 2000.

United States Department of the Interior, Bureau of Reclamation, 1987. *"Design of Small Canal Structures,"* Chapter V, Water Measurement Structures.

30% Construction Plans



LOCATION MAP

PRELIMINARY
30% CONSTRUCTION PLAN

FOR

LOS CAPITANCILLOS FRESHWATER WETLAND MITIGATION PROJECT

PROJECT NO. 1426-06

PROJECT APPROVAL:

____
GROUP MANAGER
PROJECT DEVELOPMENT GROUP

ACCEPTED BY DISTRICT:

____
SENIOR CIVIL ENGINEER
FACILITIES PLANNING AND DESIGN
PROJECT DEVELOPMENT GROUP

DATE: March 21, 2002

Santa Clara Valley Water District

PROJECT PREPARED BY:

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PRELIMINARY
NOT FOR CONSTRUCTION

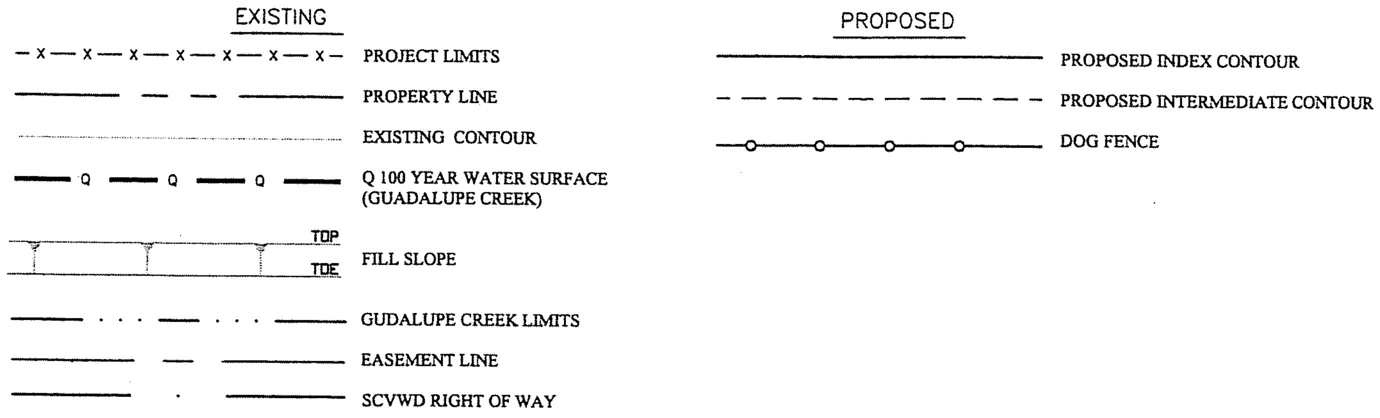
FILE NAME: O:\Projects\1426 Guadalupe Creek\Design Drawings\Sheet1_Title.dwg
DATE: 3/21/02

SHEET INDEX

#	SHEET TITLE
1	TITLE SHEET & SITE LOCATION MAP
2	GENERAL NOTES, LEGEND & ABBREVIATIONS
3	WETLAND GRADING PLAN
4	WETLAND CROSS SECTIONS
5	WETLAND PROFILE
6	INLET WORKS - PLAN, SCHEMATIC & DETAILS
7	IRRIGATION SYSTEM - PLAN & DETAILS
8	INLET POOLS - PLAN & SECTION
9	OUTLET STRUCTURE - PLAN, PROFILE, DETAILS & SECTIONS
10	PERCOLATION NETWORK - PLAN & DETAILS
11	EMERGENCY SPILLWAY - PLAN, PROFILE & SECTION
12	OUTLET CHANNEL - PLAN
13*	OUTLET CHANNEL - PROFILE, DETAILS & SECTIONS
14	INFILTRATION POOLS & GUADALUPE CREEK OUTFALL - PLAN VIEW
15*	INFILTRATION POOLS & GUADALUPE CREEK OUTFALL- PROFILE, DETAILS & SECTIONS
16	PLANTING PLAN - PLAN
17*	PLANTING PLAN - DETAILS AND SECTIONS
18*	PLANTING PLAN - DETAILS
19	ACCESS PLAN
20	ACCESS PLAN - DETAILS

* NOT INCLUDED IN 30% CONSTRUCTION PLANS.

LINE TYPE LEGEND



EXISTING

- PROJECT LIMITS
- PROPERTY LINE
- EXISTING CONTOUR
- Q 100 YEAR WATER SURFACE (GUADALUPE CREEK)
- FILL SLOPE
- GUDALUPE CREEK LIMITS
- EASEMENT LINE
- SCVWD RIGHT OF WAY

PROPOSED

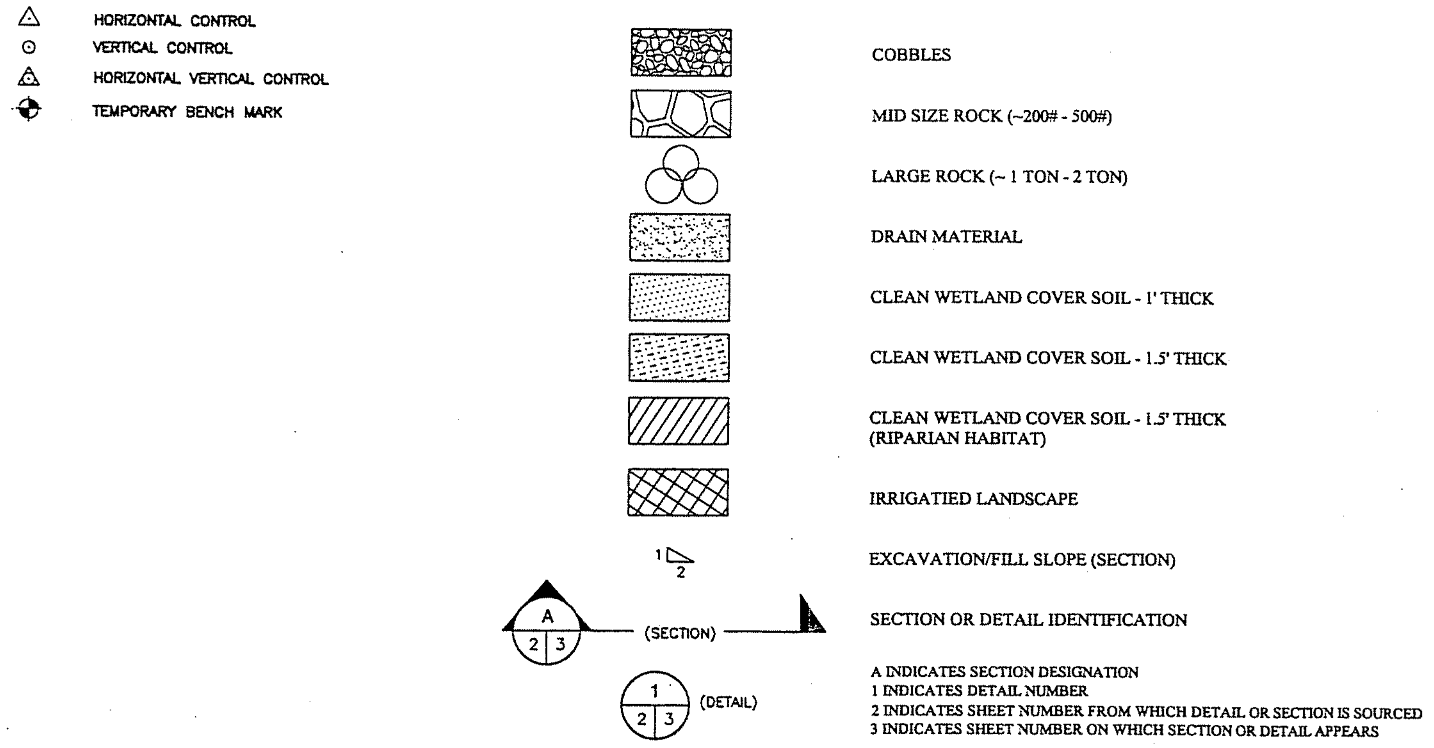
- PROPOSED INDEX CONTOUR
- PROPOSED INTERMEDIATE CONTOUR
- DOG FENCE

ABBREVIATIONS:

APPROX	APPROXIMATE	(N)	NEW
℄	CENTERLINE	NA	NOT APPLICABLE
C.S.	COUNTY SPECIFICATIONS	N.I.C.	NOT IN CONTRACT
DS	DOWNSTREAM	NTS	NOT TO SCALE
(E), EXIST	EXISTING	O.C.	ON CENTER
ELEV	ELEVATION	Q	FLOW
EQ	EQUAL	SHT	SHEET
ECF	EROSION CONTROL FABRIC	S	SLOPE
FE	FLOWAGE EASEMENT	STA	STATION
F.F.	FILTER FABRIC	STD	STANDARD
FL	FLOW LINE	SP	STEP POOL
GB	GRADE BREAK	S.S.	STANDARD SPECIFICATIONS
GCS	GRADE CONTROL STRUCTURE	TOB	TOP OF BANK
HORIZ.	HORIZONTAL	TYP , (TYP.)	TYPICAL
M, m	METER	US	UPSTREAM
MAX	MAXIMUM	VERT	VERTICAL
MIN	MINIMUM	VEG	VEGETATION

℘ – Property Line

SYMBOLS LEGEND



SURVEY

- HORIZONTAL CONTROL
- VERTICAL CONTROL
- HORIZONTAL VERTICAL CONTROL
- TEMPORARY BENCH MARK

PROPOSED

- COBBLES
- MID SIZE ROCK (~200# - 500#)
- LARGE ROCK (~ 1 TON - 2 TON)
- DRAIN MATERIAL
- CLEAN WETLAND COVER SOIL - 1' THICK
- CLEAN WETLAND COVER SOIL - 1.5' THICK
- CLEAN WETLAND COVER SOIL - 1.5' THICK (RIPARIAN HABITAT)
- IRRIGATIED LANDSCAPE
- EXCAVATION/FILL SLOPE (SECTION)
- SECTION OR DETAIL IDENTIFICATION

A INDICATES SECTION DESIGNATION
1 INDICATES DETAIL NUMBER
2 INDICATES SHEET NUMBER FROM WHICH DETAIL OR SECTION IS SOURCED
3 INDICATES SHEET NUMBER ON WHICH SECTION OR DETAIL APPEARS

PRELIMINARY
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	APPR

REFERENCE INFORMATION AND NOTES

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DATE 03/26/02
DESIGN ML
DRAWN EBH
CHECKED AEB

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE
PROJECT ENGINEER

Los Capitancillos Freshwater Wetland Mitigation Project

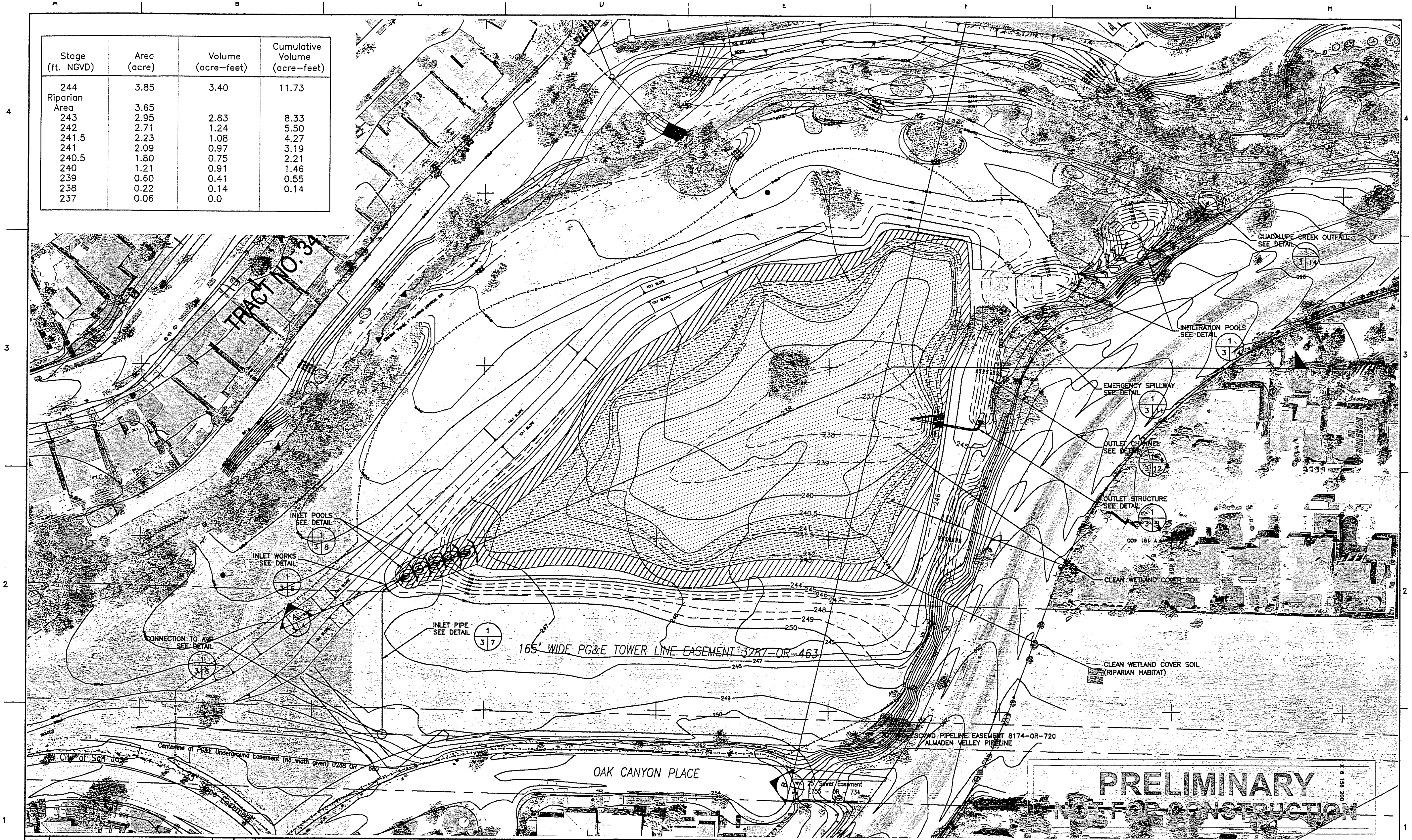
General Notes, Legend & Abbreviations

VERIFY SCALES
0 1/2"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE NOT TO SCALE
SHEET 2
2 OF 20

DWG FILE NAME: Q:\Projects\1426 Guadalupe Creek\Design Drawings\Sheet2_Legend.dwg

Stage (ft. NGVD)	Area (acre)	Volume (acre−feet)	Cumulative Volume (acre−feet)
244	3.85	3.40	11.73
Riparian Area	3.65		
243	2.95	2.83	8.33
242	2.71	1.24	5.50
241.5	2.23	1.08	4.27
241	2.09	0.97	3.19
240.5	1.80	0.75	2.21
240	1.21	0.91	1.46
239	0.60	0.41	0.55
238	0.22	0.14	0.14
237	0.06	0.0	


TRACT NO. 34
GUADALUPE CREEK OUTFALL SEE DETAIL 3 14
INFILTRATION POOLS SEE DETAIL 1 3 14
EMERGENCY SPILLWAY SEE DETAIL 1 3 11
OUTLET CHANNEL SEE DETAIL 1 3 12
OUTLET STRUCTURE SEE DETAIL 1 3 9
CLEAN WETLAND COVER SOIL
CLEAN WETLAND COVER SOIL (RIPARIAN HABITAT)
INLET POOLS SEE DETAIL 1 3 8
INLET WORKS SEE DETAIL 1 3 6
INLET PIPE SEE DETAIL 1 3 7
CONNECTION TO AVP SEE DETAIL 1 3 8
165' WIDE PG&E TOWER LINE EASEMENT 3287-OR-463
10:1 SLOPE
237
238
239
240
240.5
241
241.5
242
244
245
246
247
248
249
250
252
253
254
255
30' WIDE SCVWD PIPELINE EASEMENT 8174-OR-720
ALMADEN VELLEY PIPELINE
OAK CANYON PLACE
25' Sewer Easement E756 - OR - 734
Centerline of PG&E Underground Easement (no width given) 0268 OR 660
City of San Jose
25' Slope Easement
PRELIMINARY
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	APPR

REFERENCE INFORMATION AND NOTES

PWA

PHILIP WILLIAMS & ASSOCIATES, LTD.
770 TAMALPAIS DRIVE, SUITE 401
CORTE MADERA, CALIFORNIA 94925
PHONE (415) 945-0600 FAX (415) 945-0606

DATE	04/22/02
DESIGN	ML
DRAWN	EBH
CHECKED	AEB

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

PROJECT ENGINEER

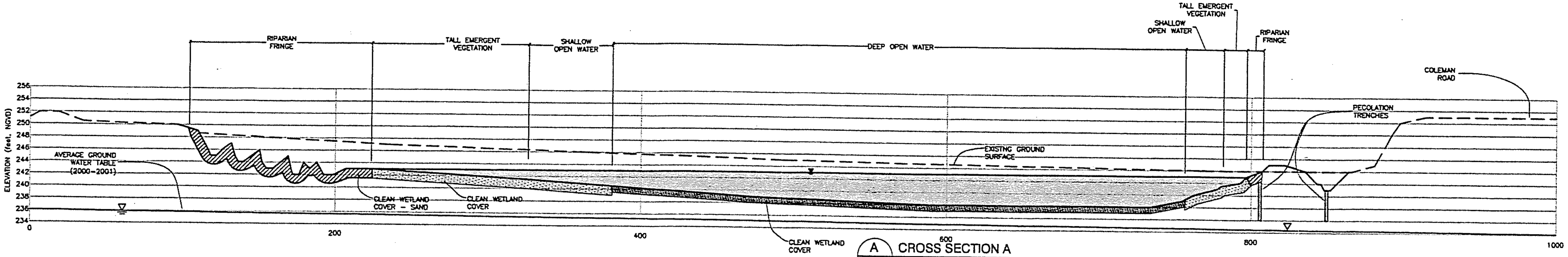
Los Capitancillos Freshwater Wetland Mitigation Project

Wetland Grading Plan

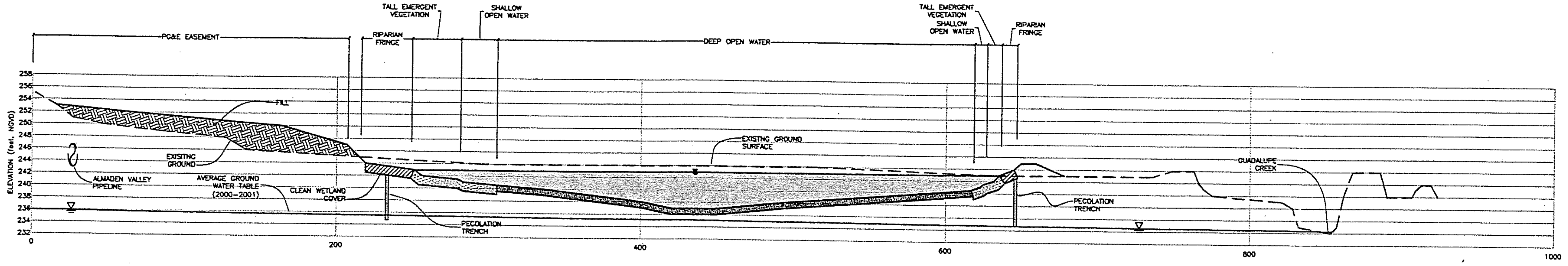
VERIFY SCALES
0 1/2"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
1"=100'

SHEET
3
3 OF 20



A
3 | 4
CROSS SECTION A



B
3 | 4
CROSS SECTION B

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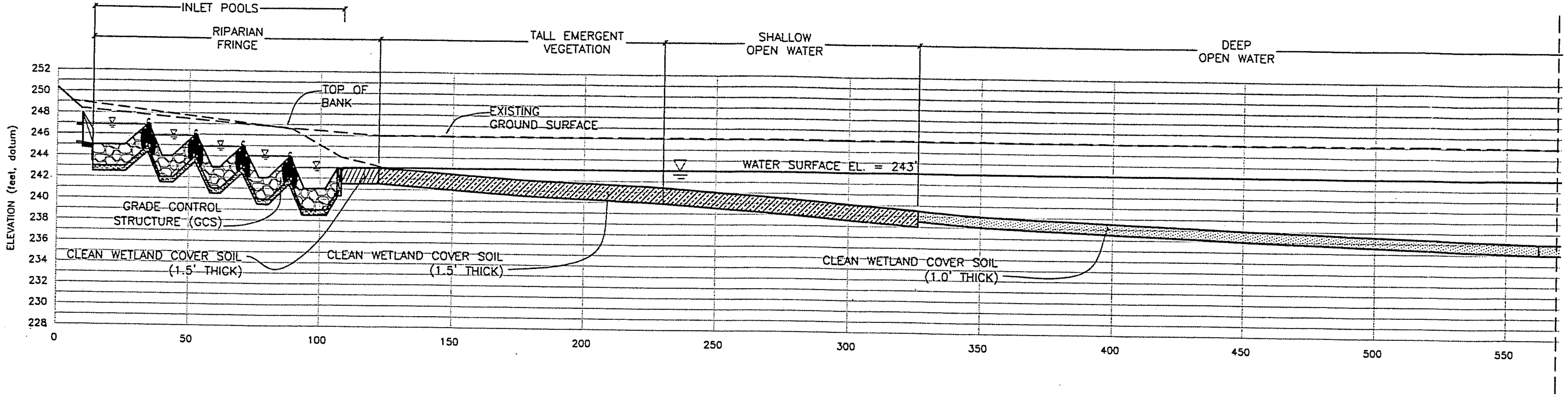
Los Capitancillos Freshwater Wetland Mitigation Project

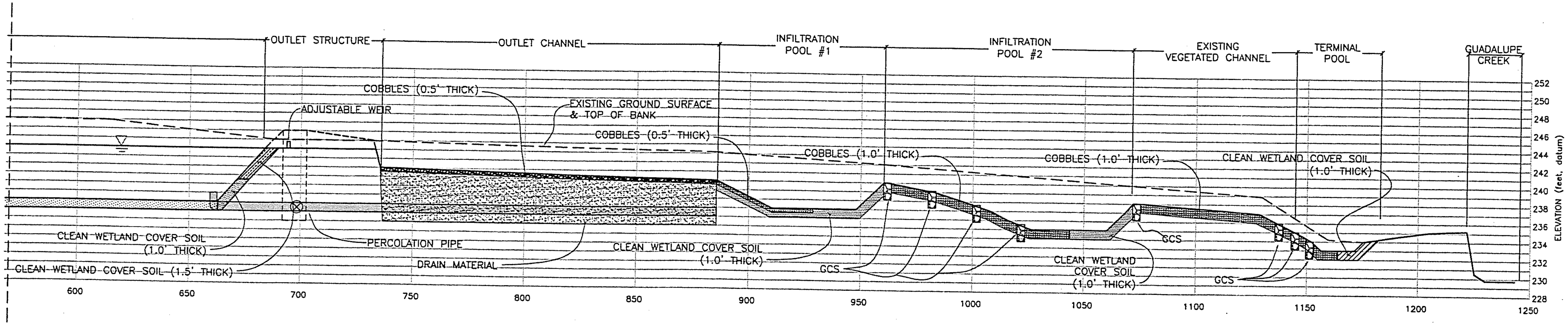
Wetland Cross Sections

VERIFY SCALES
0 1/2"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
As Shown

SHEET
4
4 OF 20





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DATE 03/22/02
DESIGN ML
DRAWN EBH
CHECKED AEB

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE
PROJECT ENGINEER

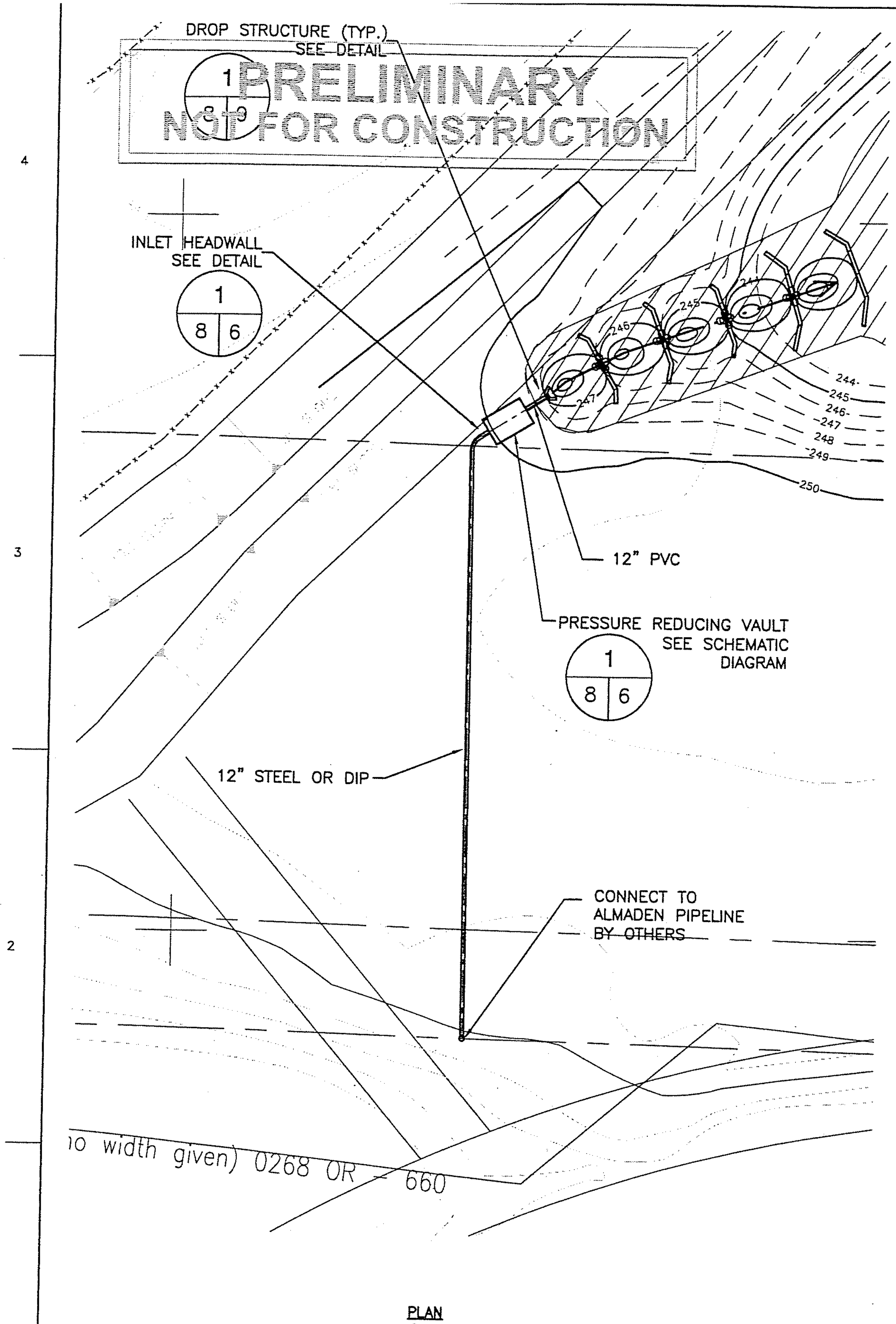
Los Capitancillos Freshwater Wetland Mitigation Project

Wetland Profile

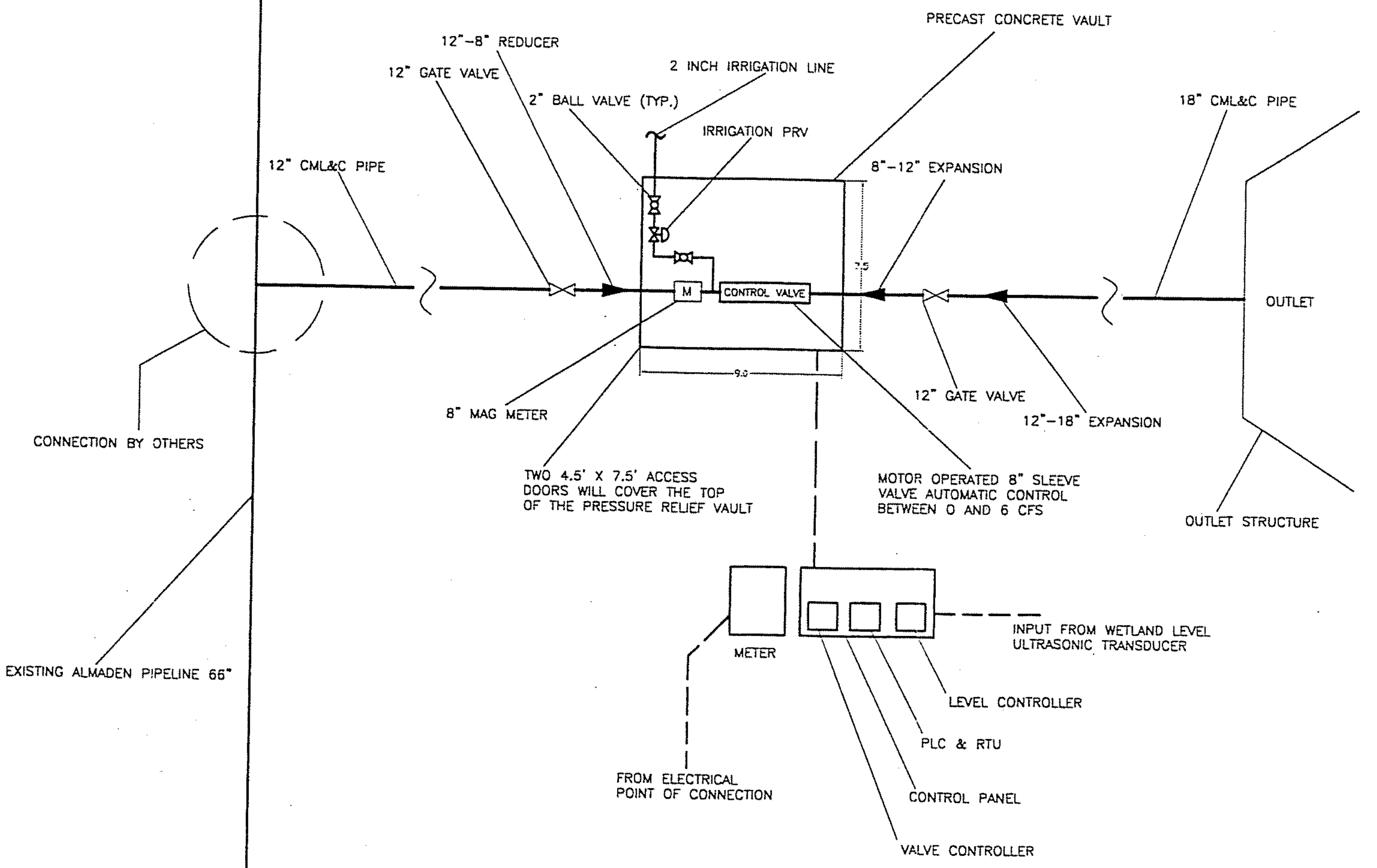
VERIFY SCALES
0 1/2"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

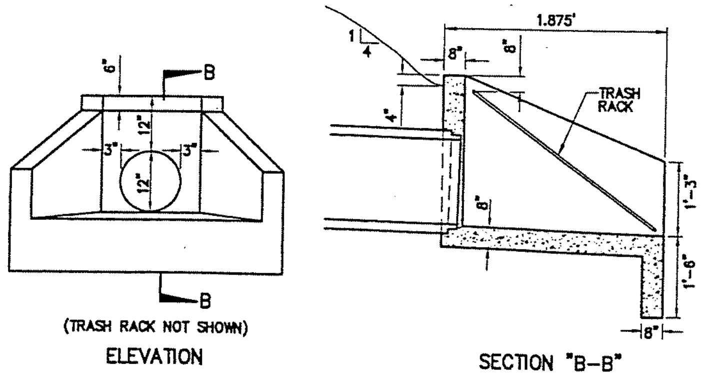
SCALE
AS SHOWN

SHEET
5
5 OF 20

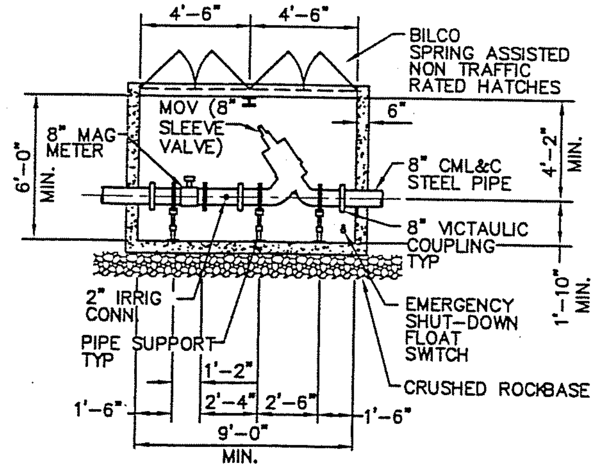


PLAN
1"=20'





INLET HEADWALL
N.T.S.



PRESSURE REDUCING VAULT
N.T.S.

REV	DESCRIPTION	DATE	APPR

REFERENCE INFORMATION AND NOTES

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RBF CONSULTING
IRVINE, CALIFORNIA

DATE 03/21/02
DESIGN ML
DRAWN EBH
CHECKED AEB

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE
PROJECT ENGINEER

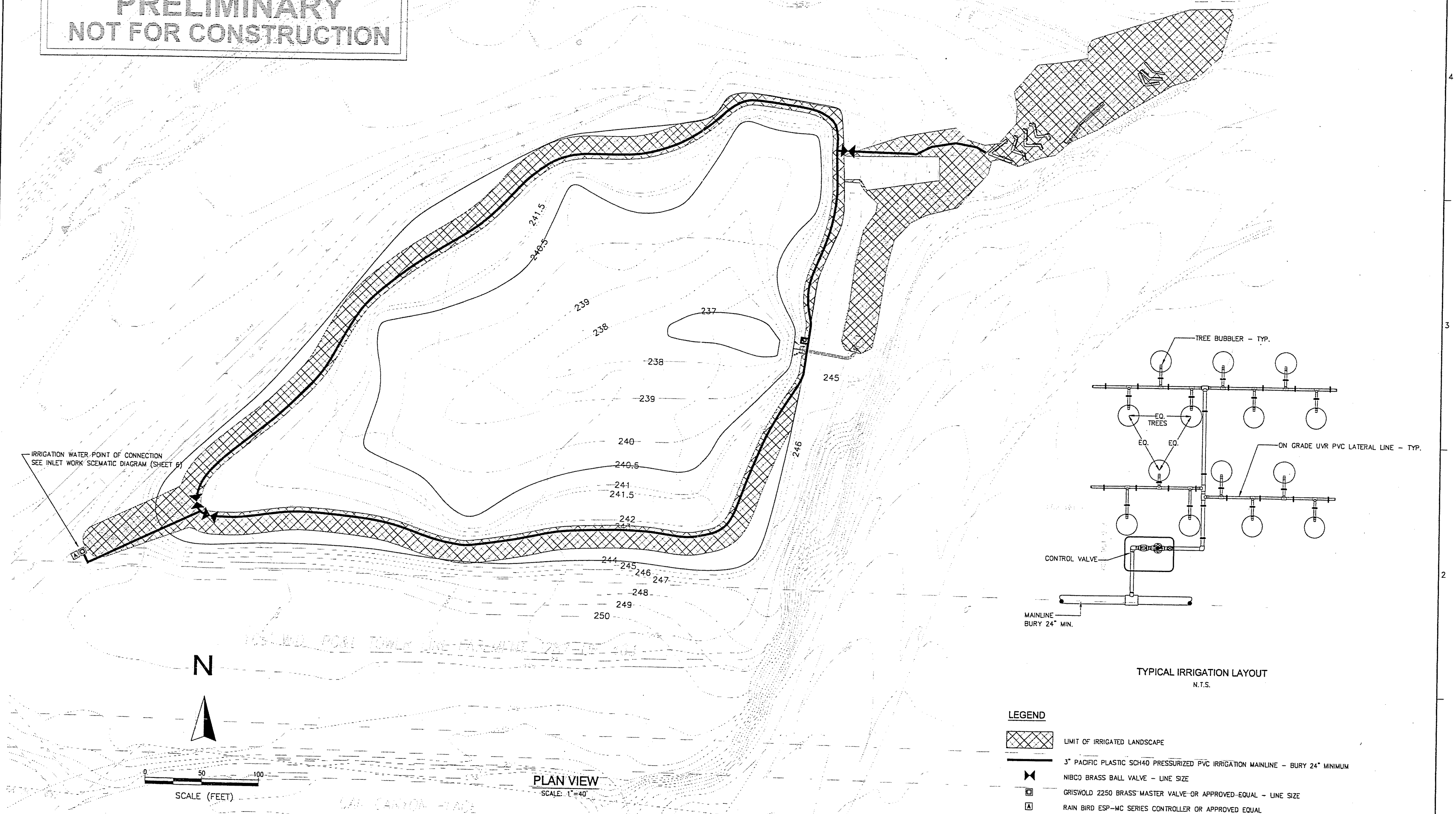
Los Capitancillos Freshwater Wetland Mitigation Project

Inlet Works
Plan, Schematic & Details

VERIFY SCALES
0 1/2"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE varies
SHEET 6
6 OF 20

PRELIMINARY
NOT FOR CONSTRUCTION



PLAN VIEW

SCALE: 1"=40'

TYPICAL IRRIGATION LAYOUT

N.T.S.

LEGEND

▨	LIMIT OF IRRIGATED LANDSCAPE
━	3" PACIFIC PLASTIC SCH40 PRESSURIZED PVC IRRIGATION MAINLINE – BURY 24" MINIMUM
⋈	NIBCO BRASS BALL VALVE – LINE SIZE
▣	GRISWOLD 2250 BRASS MASTER VALVE OR APPROVED EQUAL – LINE SIZE
A	RAIN BIRD ESP–MC SERIES CONTROLLER OR APPROVED EQUAL

REV	DESCRIPTION	DATE	APPR

REFERENCE INFORMATION AND NOTES

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IRVINE, CALIFORNIA

DATE	03/21/02
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CHECKED	AEB

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

PROJECT ENGINEER

Los Caputancillos Freshwater Wetland Mitigation Project

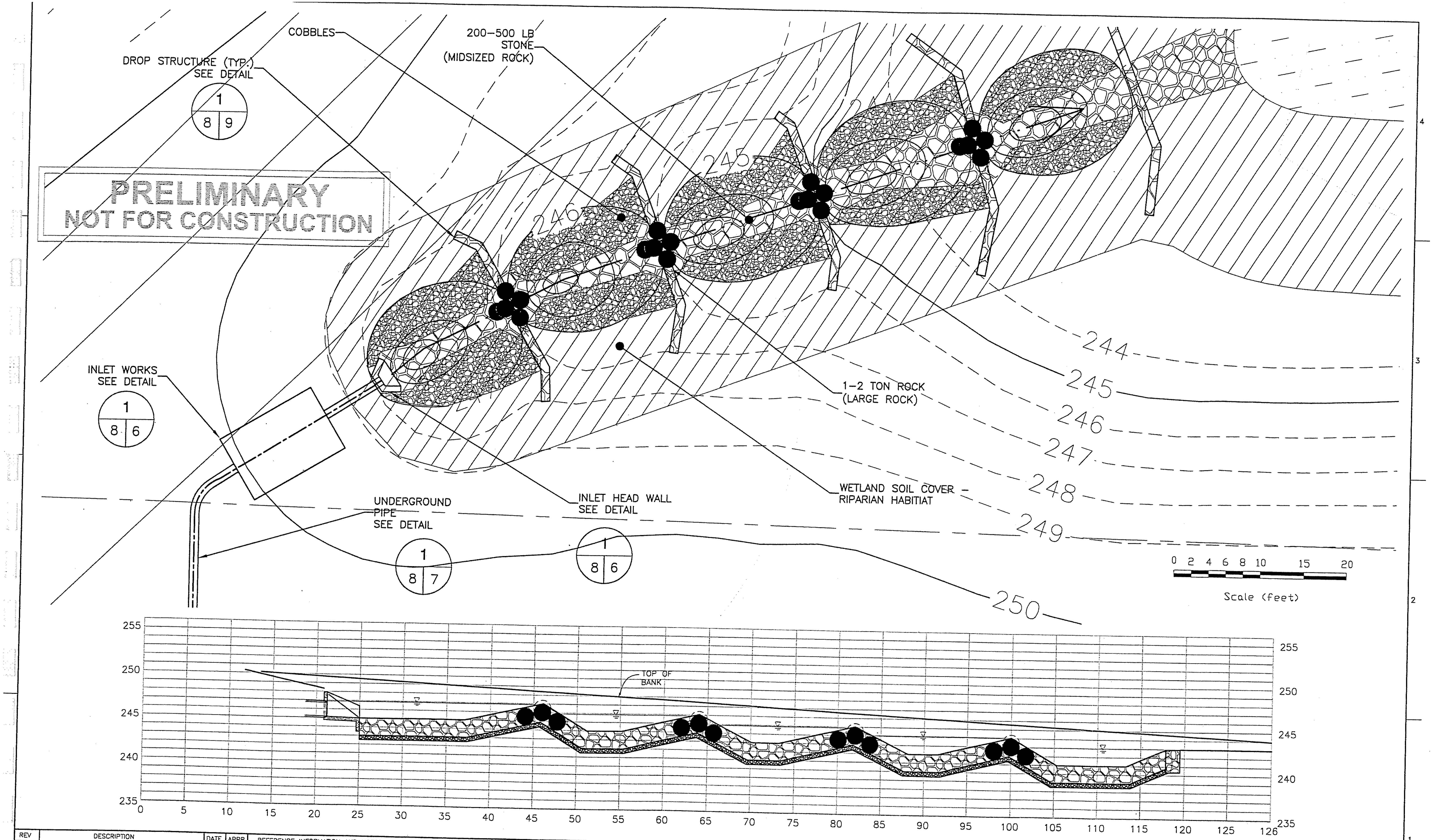
Irrigation System Plan & Details

VERIFY SCALES
0 1/2"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
varies

SHEET
7
7 OF 20

PRELIMINARY
NOT FOR CONSTRUCTION



REV	DESCRIPTION	DATE	APPR

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EBH
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AEB

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

PROJECT ENGINEER

Los Capitancillos Freshwater Wetland Mitigation Project

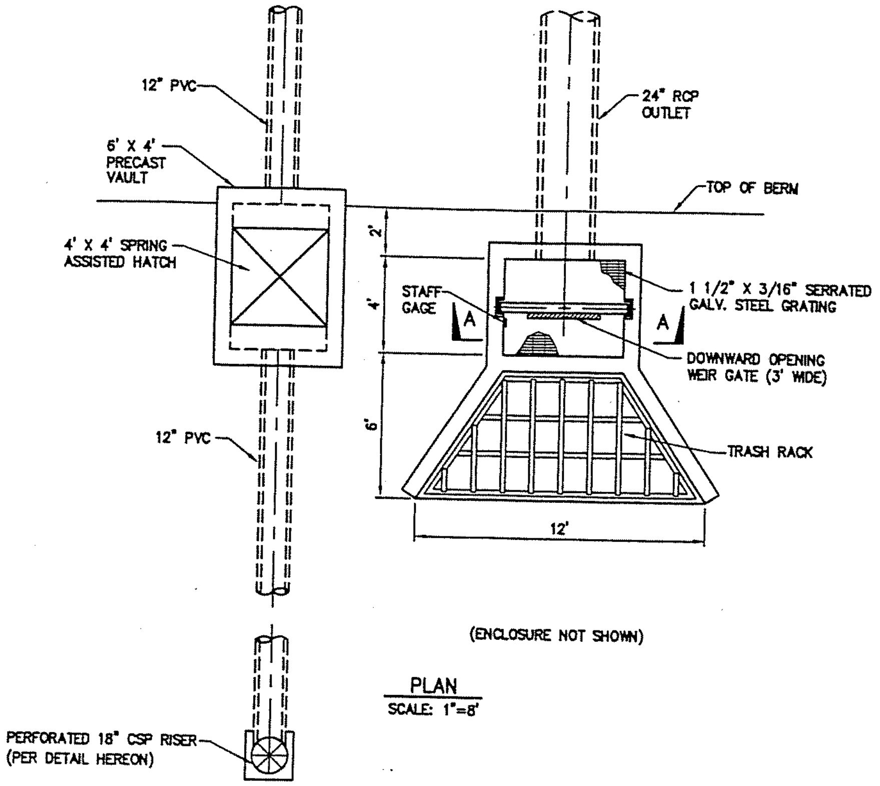
Inlet Pools
Plan & Section

VERIFY SCALES
0 1/2"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
1"=100'

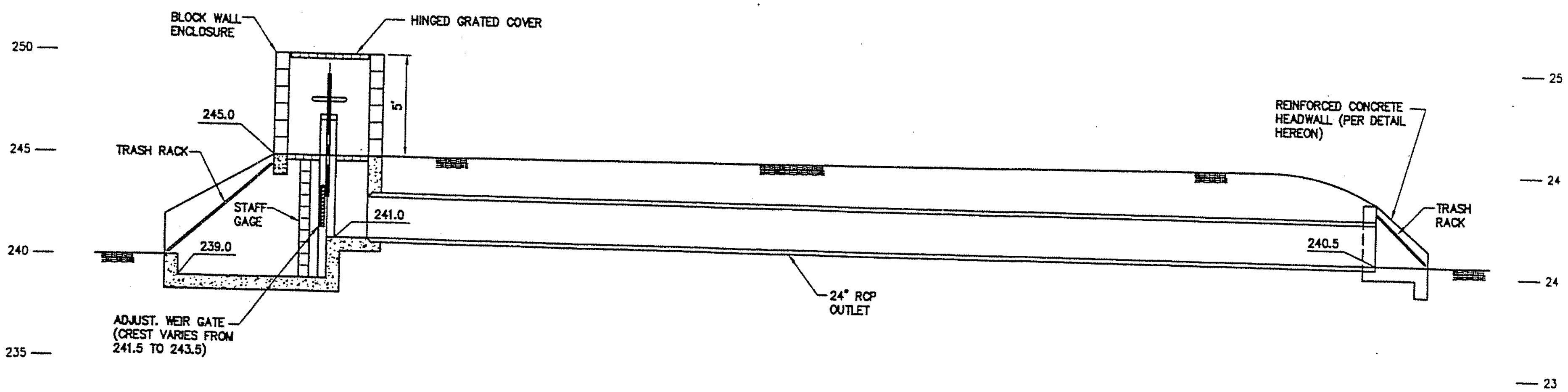
SHEET
8
22 OF 20

PRELIMINARY
NOT FOR CONSTRUCTION

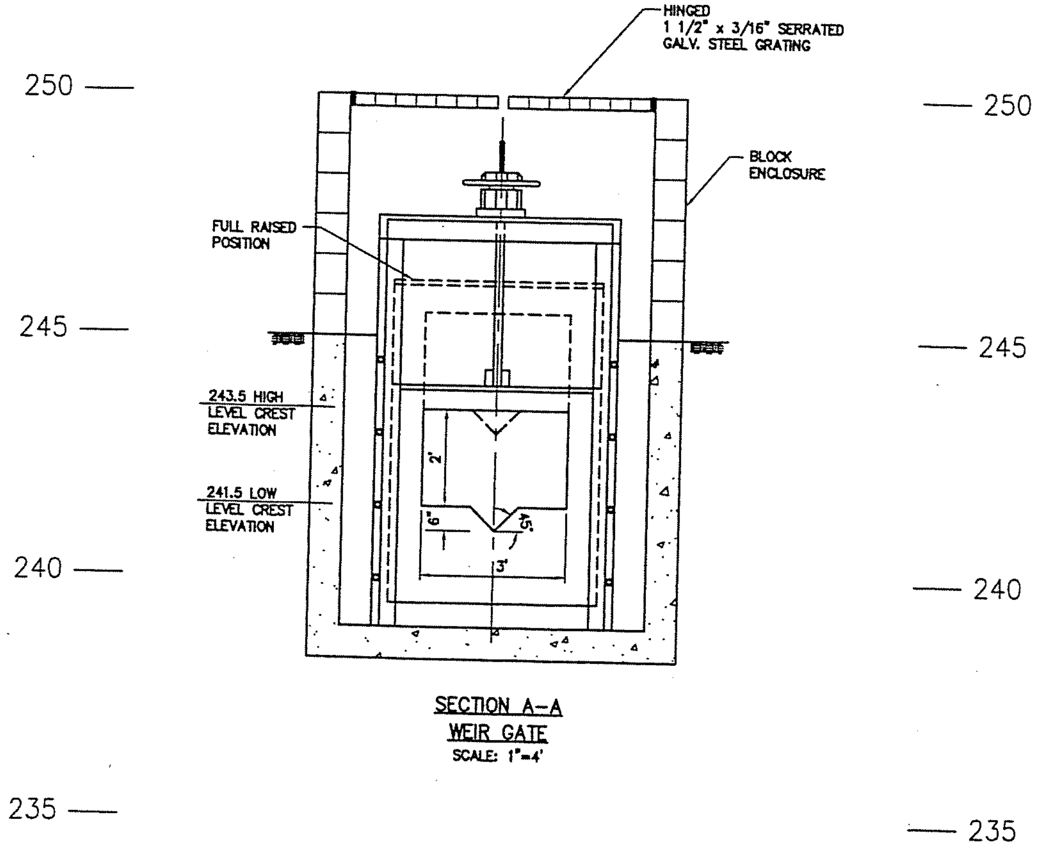

12" PVC
6' X 4' PRECAST VAULT
4' X 4' SPRING ASSISTED HATCH
12" PVC
24" RCP OUTLET
TOP OF BERM
2'
4'
6'
STAFF GAGE
A
A
1 1/2" X 3/16" SERRATED GALV. STEEL GRATING
DOWNWARD OPENING WEIR GATE (3' WIDE)
TRASH RACK
12'
PERFORATED 18" CSP RISER (PER DETAIL HEREON)

(ENCLOSURE NOT SHOWN)

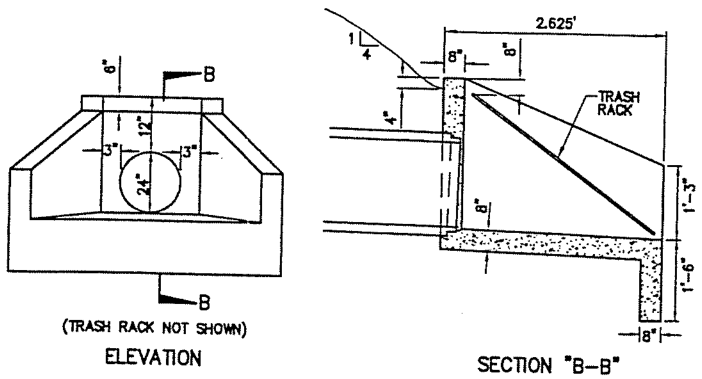
PLAN
SCALE: 1"=8'



PROFILE
SCALE: 1"=8'


250
245
240
235
250
245
240
235
HINGED 1 1/2" x 3/16" SERRATED GALV. STEEL GRATING
BLOCK ENCLOSURE
FULL RAISED POSITION
243.5 HIGH LEVEL CREST ELEVATION
241.5 LOW LEVEL CREST ELEVATION
2'
6"
45°
3'

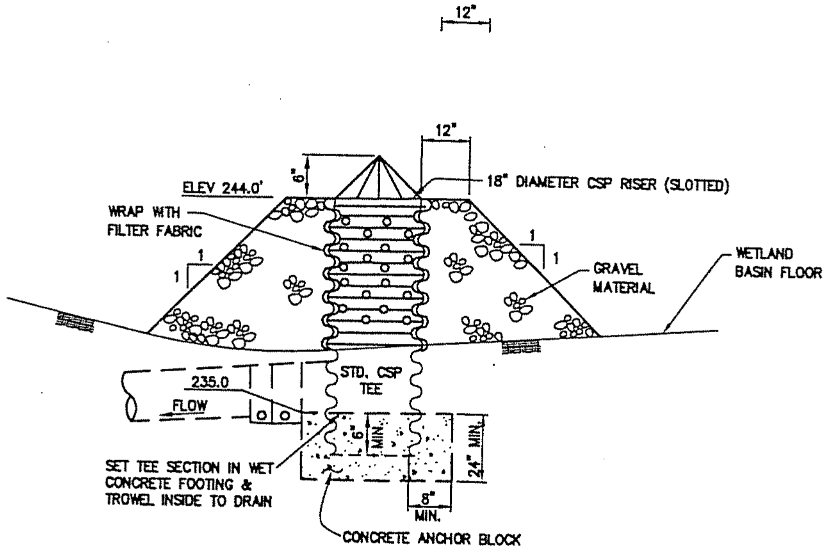
SECTION A–A
WEIR GATE
SCALE: 1"=4'



(TRASH RACK NOT SHOWN)
ELEVATION

SECTION "B–B"

REINFORCED CONCRETE HEADWALL
N.T.S.



18" DIA PERFORATED CSP RISER
N.T.S.

REV	DESCRIPTION	DATE	APPR

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CHECKED AEB

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE
PROJECT ENGINEER

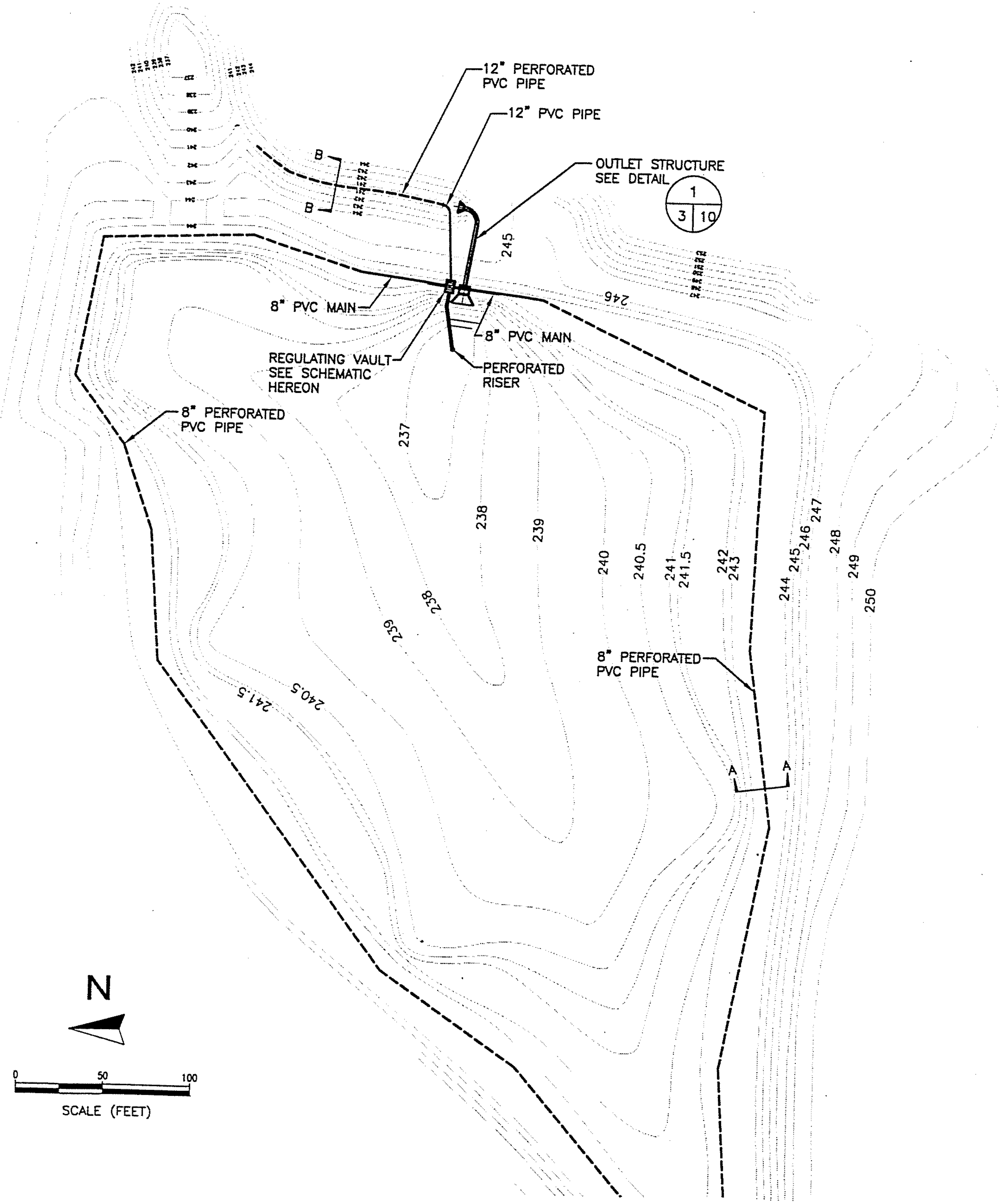
Los Caputancillos Freshwater Wetland Mitigation Project

Outlet Structure
Plan, Profile, Details & Sections

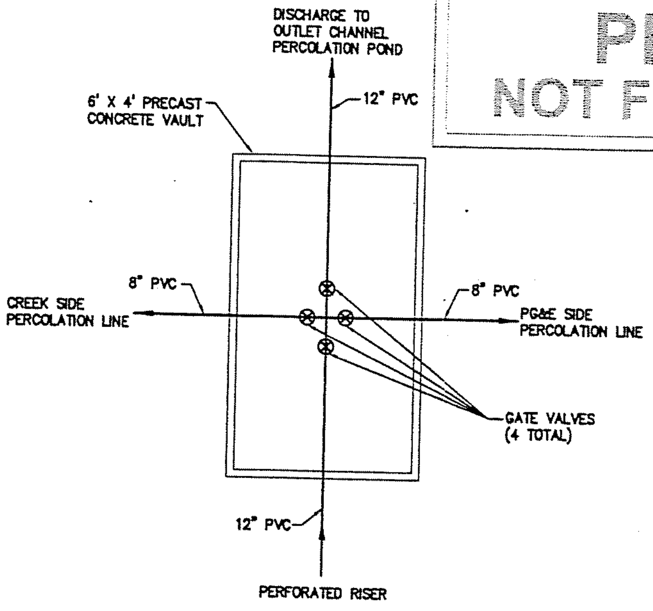
VERIFY SCALES
0 1/2"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE varies
SHEET 9
9 OF 20

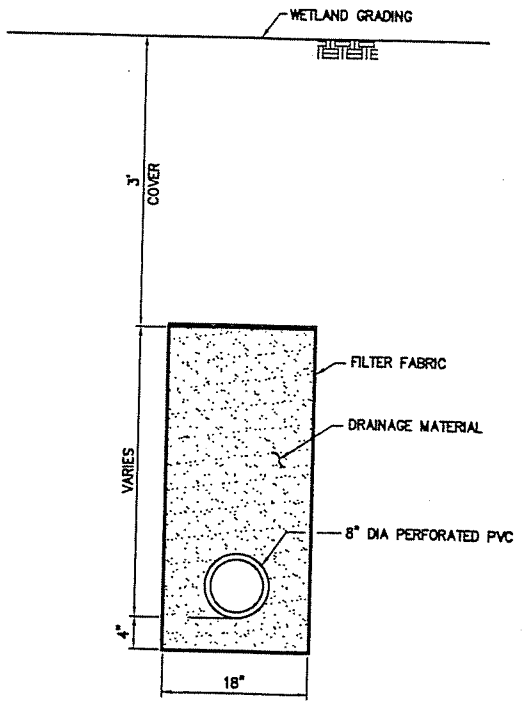
PRELIMINARY
NOT FOR CONSTRUCTION



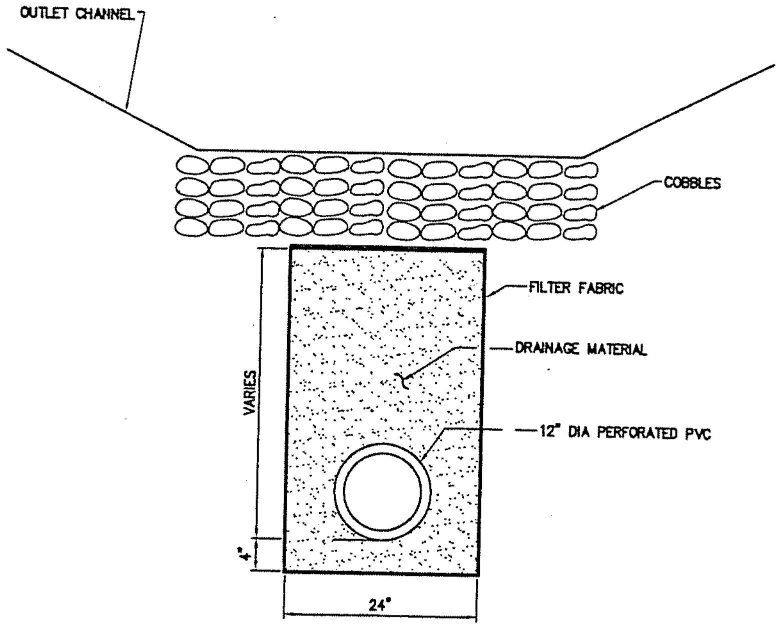
PLAN VIEW
SCALE: 1"=40'


DISCHARGE TO OUTLET CHANNEL PERCOLATION POND
12" PVC
6' X 4' PRECAST CONCRETE VAULT
8" PVC
8" PVC
CREEK SIDE PERCOLATION LINE
PG&E SIDE PERCOLATION LINE
GATE VALVES (4 TOTAL)
12" PVC
PERFORATED RISER

REGULATING VAULT
SCHEMATIC DIAGRAM
SCALE: 1"=1'-0"



TYPICAL SECTION A–A
PERCOLATION PIPE TRENCH
SCALE: 1"=1'-0"



TYPICAL SECTION B–B
OUTLET PIPE PERCOLATION TRENCH
SCALE: 1"=1'-0"

REV	DESCRIPTION	DATE	APPR

REFERENCE INFORMATION AND NOTES

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770 TAMALPAIS DRIVE, SUITE 401
CORTE MADERA, CALIFORNIA 94925
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IRVINE, CALIFORNIA

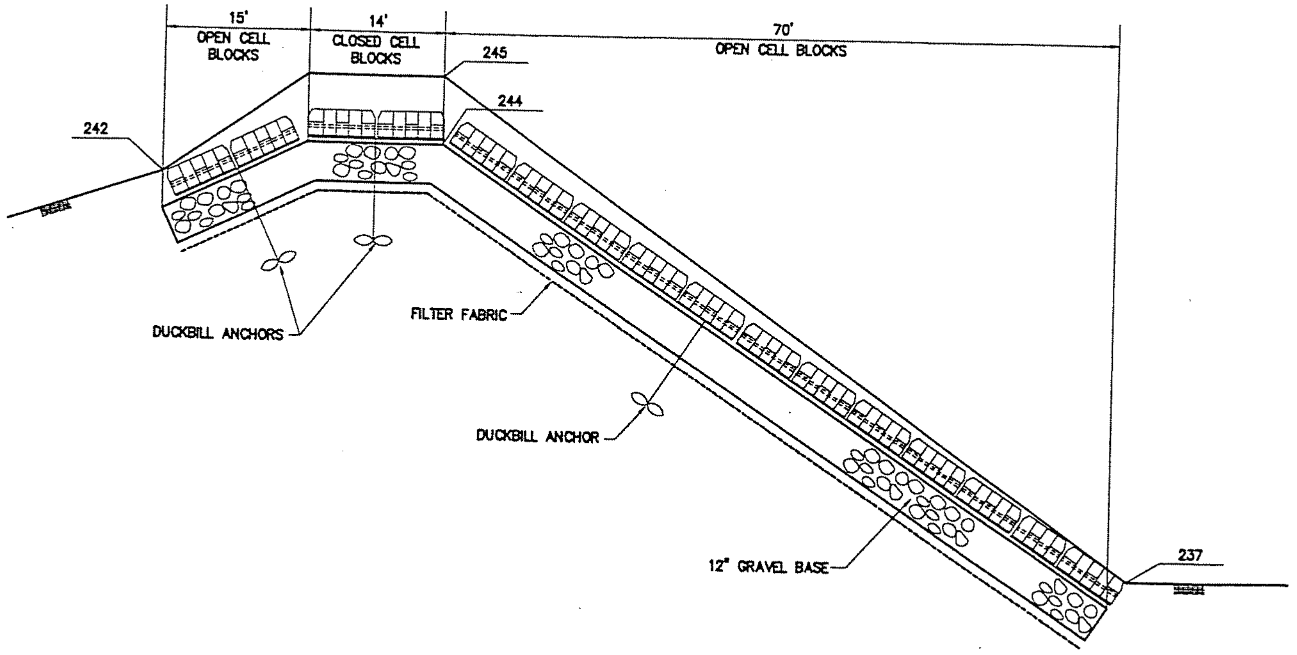
DATE 03/22/02
DESIGN ML
DRAWN EBH
CHECKED AEB

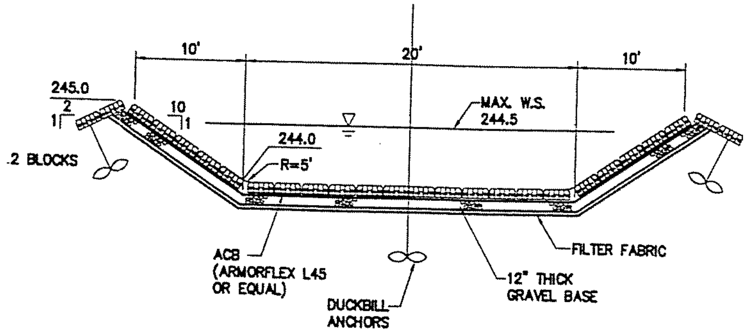
Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE
PROJECT ENGINEER

Los Capitancillos Freshwater Wetland Mitigation Project
Percolation Network
Plan & Details

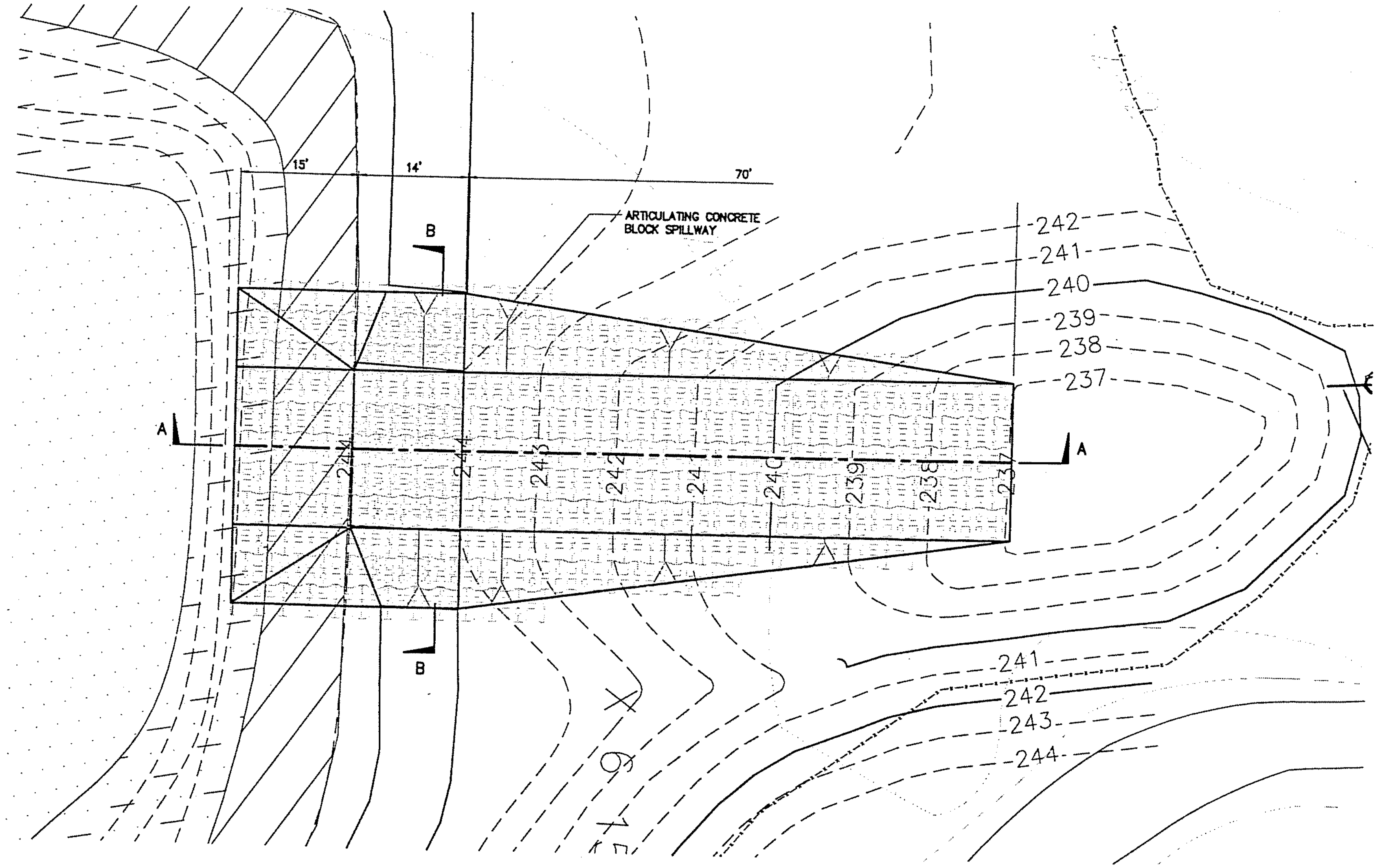
VERIFY SCALES
0 1/2"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

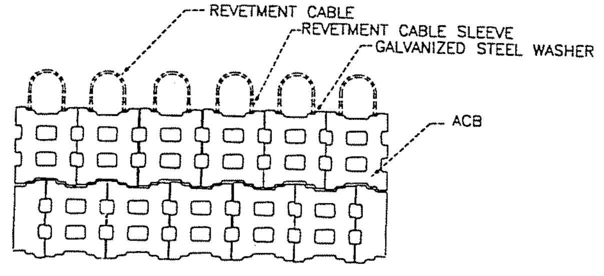
SCALE
As Shown
SHEET
10
10 OF 20



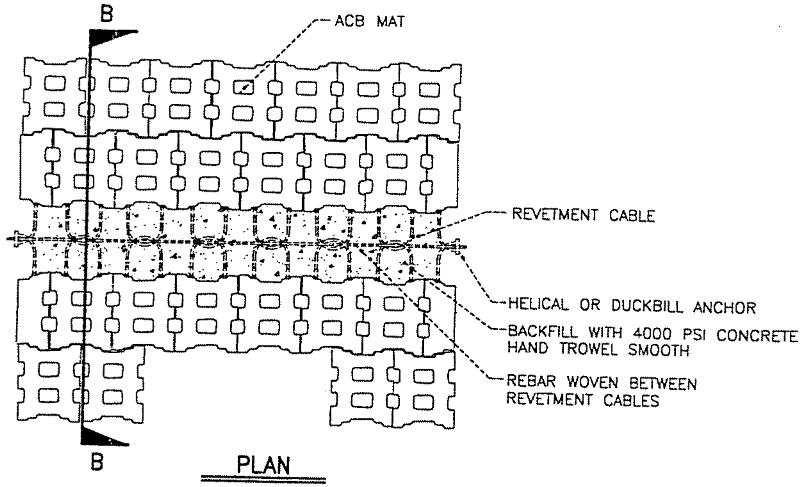


PRELIMINARY
NOT FOR CONSTRUCTION





PLAN VIEW
NOT TO SCALE


B
ACB MAT
REVETMENT CABLE
HELICAL OR DUCKBILL ANCHOR
BACKFILL WITH 4000 PSI CONCRETE HAND TROWEL SMOOTH
REBAR WOVEN BETWEEN REVETMENT CABLES
B

PLAN
NOT TO SCALE

REV	DESCRIPTION	DATE	APPR

REFERENCE INFORMATION AND NOTES

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IRVINE, CALIFORNIA

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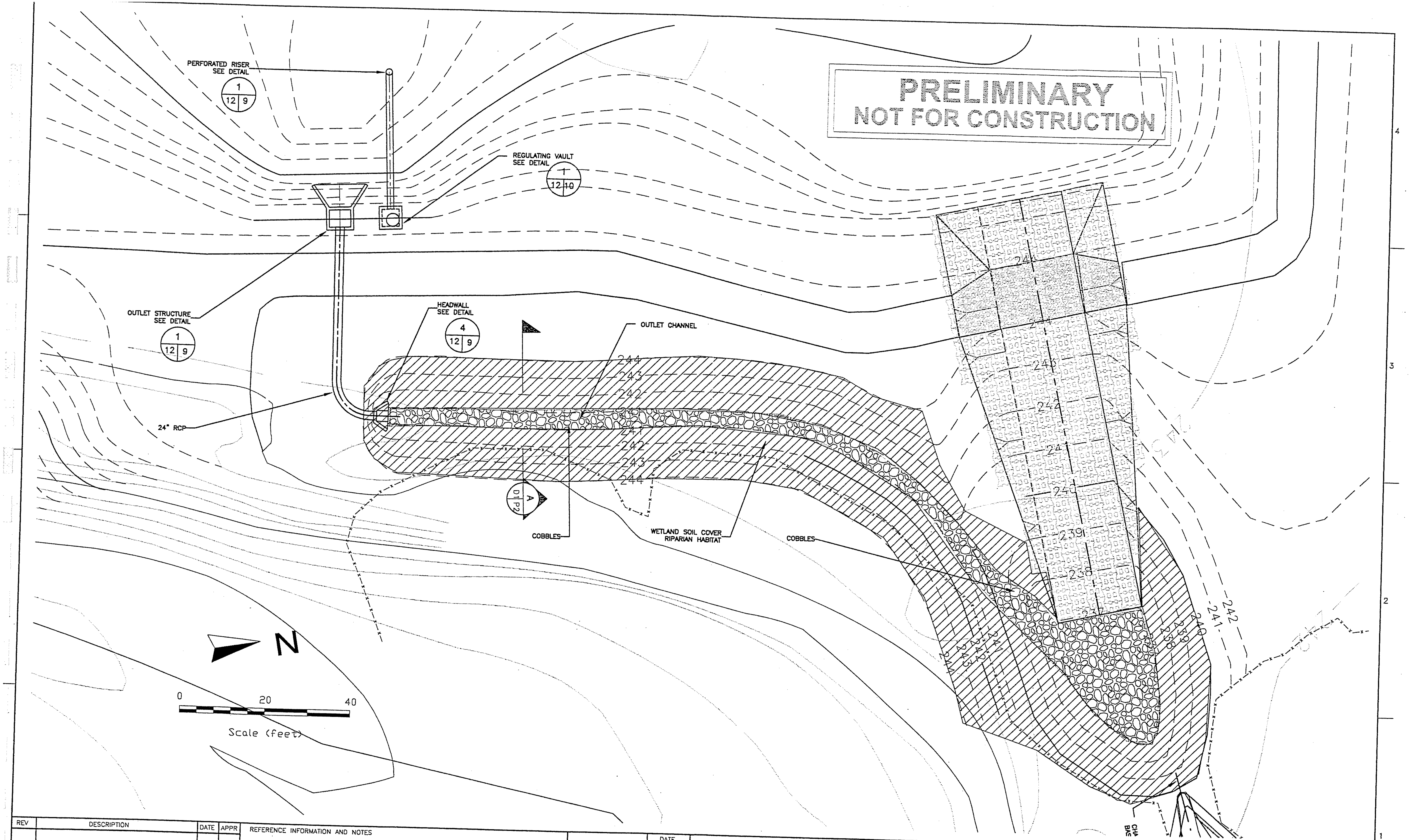
Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE
PROJECT ENGINEER

Los Capitancillos Freshwater Wetland Mitigation Project

Emergency Spillway Plan, Profile & Section

VERIFY SCALES
0 1/2"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE varies
SHEET 11
11 OF 20



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DATE 03/21/02
DESIGN ML
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Santa Clara Valley Water District
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DATE
PROJECT ENGINEER

Los Capitancillos Freshwater Wetland Mitigation Project

Outlet Channel Plan

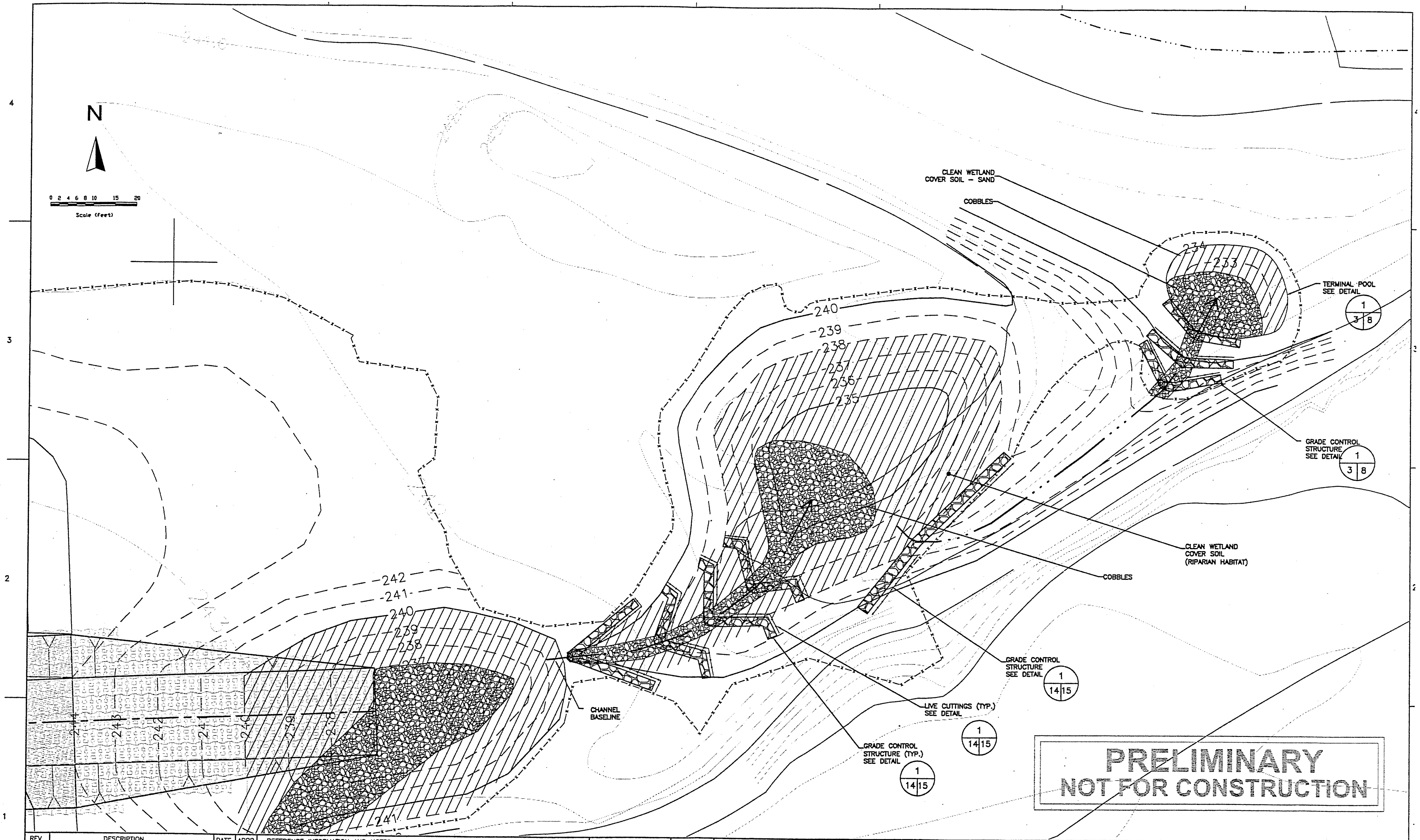
VERIFY SCALES
0 1/2"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE 1"=20'
SHEET 12
12 OF 20

LOS CAPITANCILLOS
FRESHWATER WETLAND
MITIGATION PROJECT

Sheet
13
Outlet Channel – Profile, Details & Sections

Not Included in
30% Construction Plans


N
0 2 4 6 8 10 15 20
Scale (Feet)
242
241
240
239
238
237
236
235
234
233
244
243
CLEAN WETLAND COVER SOIL - SAND
COBBLES
TERMINAL POOL SEE DETAIL
1 3 8
GRADE CONTROL STRUCTURE SEE DETAIL
1 3 8
CLEAN WETLAND COVER SOIL (RIPARIAN HABITAT)
COBBLES
GRADE CONTROL STRUCTURE SEE DETAIL
1 14 15
LIVE CUTTINGS (TYP.) SEE DETAIL
1 14 15
GRADE CONTROL STRUCTURE (TYP.) SEE DETAIL
1 14 15
CHANNEL BASELINE
1
2
3
4

PRELIMINARY
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	APPR

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DATE 04/16/02
DESIGN ML
DRAWN EBH
CHECKED AEB

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

PROJECT ENGINEER

Los Capitancillos Freshwater Wetland Mitigation Project

Infiltration Pools & Guadalupe Creek Outfall - Plan

VERIFY SCALES
0 1/2"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE 1"=20'

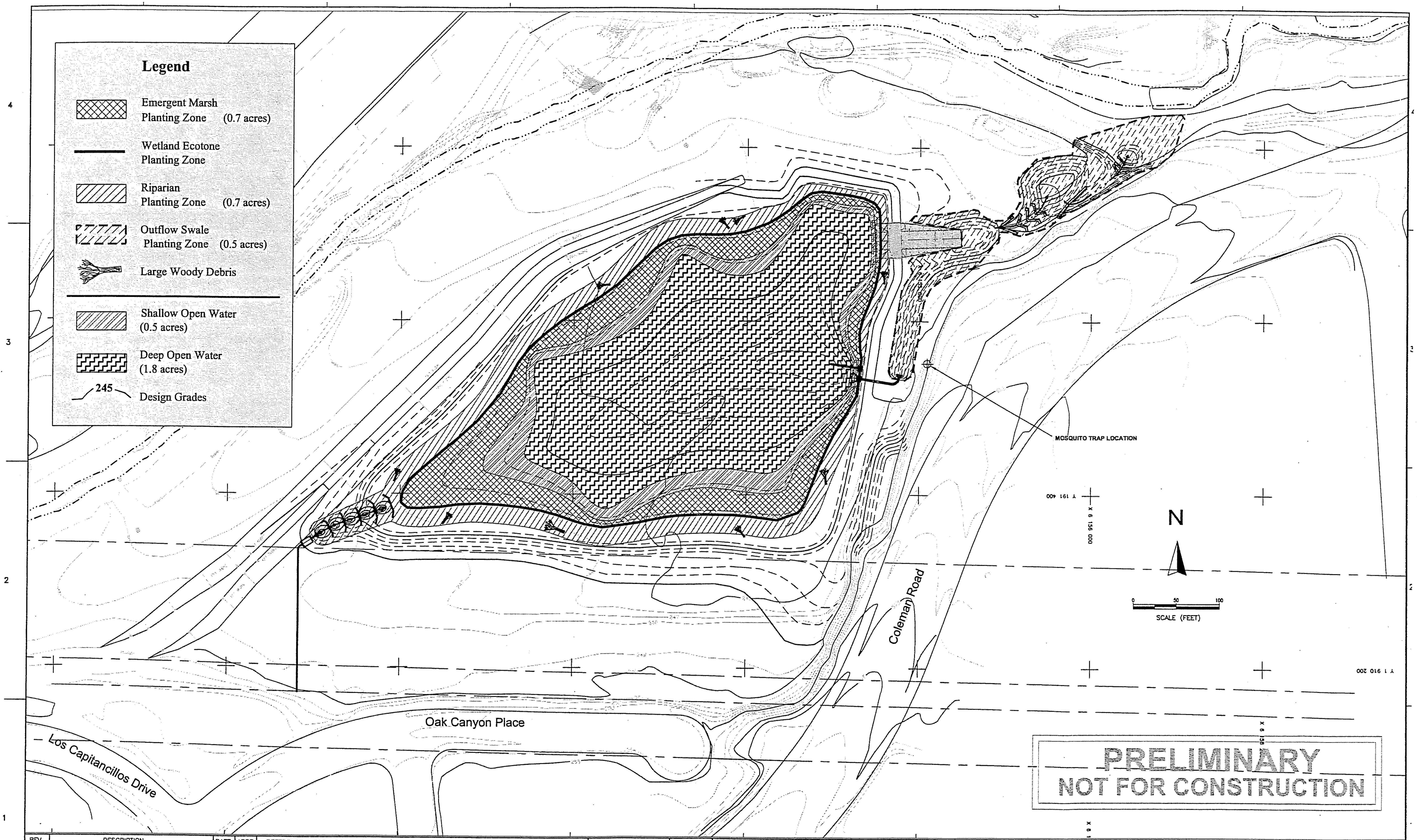
SHEET 14

14 OF 20

LOS CAPITANCILLOS
FRESHWATER WETLAND
MITIGATION PROJECT

Sheet
15
Infiltration Pools & Guadalupe Creek Outfall – Profile, Details & Sections

**Not Included in
30% Construction Plans**


Legend
▩ Emergent Marsh Planting Zone (0.7 acres)
Wetland Ecotone Planting Zone
▨ Riparian Planting Zone (0.7 acres)
Outflow Swale Planting Zone (0.5 acres)
Large Woody Debris
▨ Shallow Open Water (0.5 acres)
▦ Deep Open Water (1.8 acres)
245 Design Grades
MOSQUITO TRAP LOCATION
N
0 50 100
SCALE (FEET)
Coleman Road
Oak Canyon Place
Los Capitancillos Drive
Y 191 400
X 6 156 000
Y 1 910 200
4
3
2
1

PRELIMINARY
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	APPR

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CORTE MADERA, CALIFORNIA 94925
PHONE (415) 945-0600 FAX (415) 945-0606

H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

DATE 04/16/02
DESIGN ML
DRAWN EBH
CHECKED AEB

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE
PROJECT ENGINEER

Los Capitancillos Freshwater Wetland Mitigation Project

Planting Plan

VERIFY SCALES
0 1/2"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE 1"=100'
SHEET 16
16 OF 20

LOS CAPITANCILLOS
FRESHWATER WETLAND
MITIGATION PROJECT

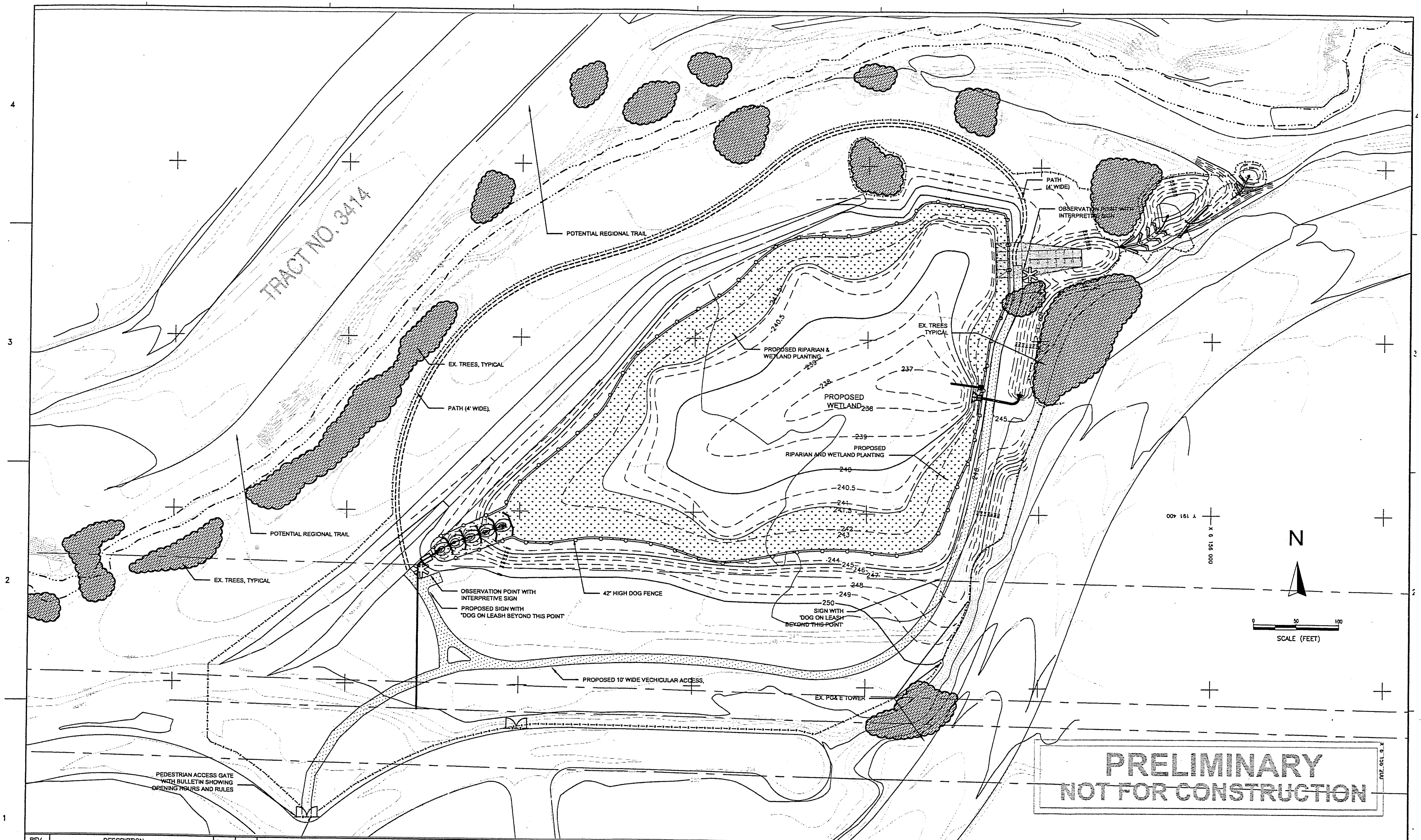
Sheet
17
Planting Plan –
Details & Sections

Not Included in
30% Construction Plans

LOS CAPITANCILLOS
FRESHWATER WETLAND
MITIGATION PROJECT

Sheet
18
Planting Plan –
Details

Not Included in
30% Construction Plans


TRACT NO. 3414
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PATH (4' WIDE).
POTENTIAL REGIONAL TRAIL
EX. TREES, TYPICAL
OBSERVATION POINT WITH INTERPRETIVE SIGN
PROPOSED SIGN WITH 'DOG ON LEASH BEYOND THIS POINT'
42" HIGH DOG FENCE
PROPOSED RIPARIAN & WETLAND PLANTING
PROPOSED WETLAND
PROPOSED RIPARIAN AND WETLAND PLANTING
SIGN WITH 'DOG ON LEASH BEYOND THIS POINT'
EX. TREES TYPICAL
PATH (4' WIDE)
OBSERVATION POINT WITH INTERPRETIVE SIGN
PROPOSED 10' WIDE VECHICULAR ACCESS,
EX. PG& E TOWER
PEDESTRIAN ACCESS GATE WITH BULLETIN SHOWING OPENING HOURS AND RULES
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PRELIMINARY
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	APPR

REFERENCE INFORMATION AND NOTES

PWA
PHILIP WILLIAMS & ASSOCIATES, LTD.
770 TAMALPAIS DRIVE, SUITE 401
CORTE MADERA, CALIFORNIA 94925
PHONE (415) 945-0600 FAX (415) 945-0606

Dillingham Associates
2927 Newbury St. Ste. B
Berkeley CA 94703

DATE	04/16/02
DESIGN	ML
DRAWN	EBH
CHECKED	AEB

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE
PROJECT ENGINEER

Los Capitancillos Freshwater Wetland Mitigation Project

Access Plan

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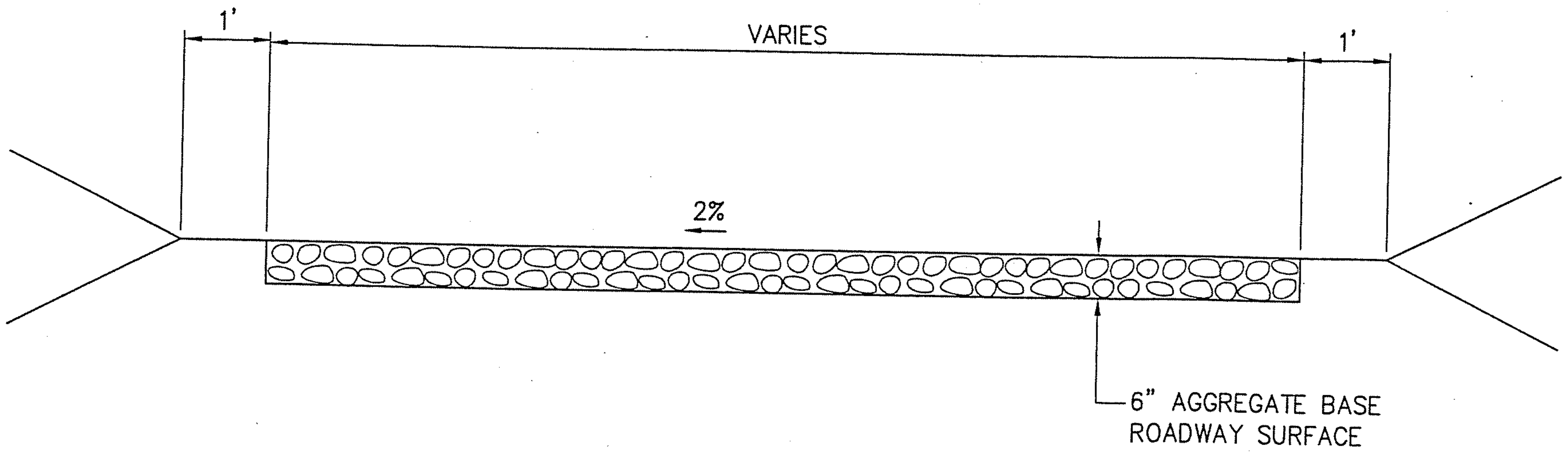

TYPICAL SECTION
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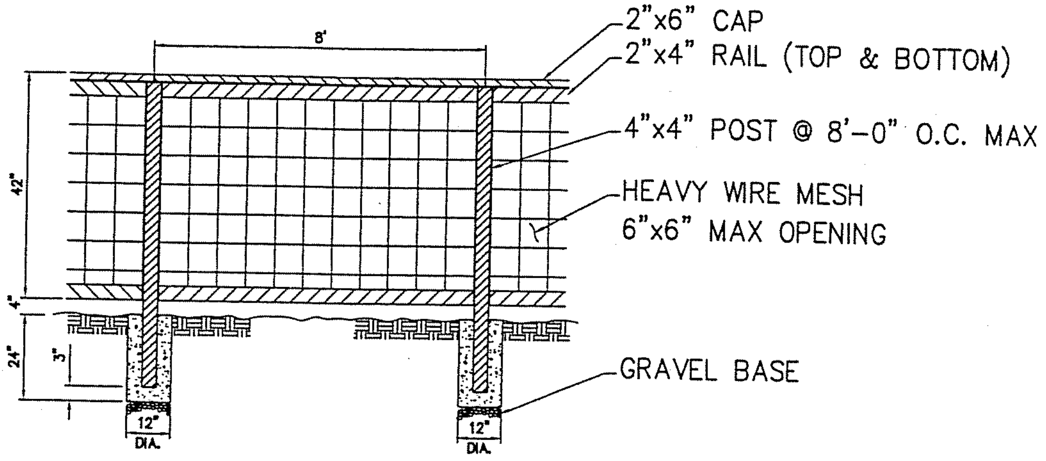

WOOD FENCE SECTION

N.T.S.

PRELIMINARY
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	APPR

REFERENCE INFORMATION AND NOTES

PWA
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IRVINE, CALIFORNIA

DATE 03/21/02
DESIGN ML
DRAWN EBH
CHECKED AEB

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE
PROJECT ENGINEER

Los Capitancillos Freshwater Wetland Mitigation Project

Access Plan Details

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E.R. Appendices

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Appendix B: Geotechnical Report *(Previously Submitted)*

Appendix C: Eutrophication Analysis

Appendix D: Soils Report *(Previously Submitted)*

Appendix E: Soil Hazardous Materials Test Results

Appendix F: Soil Cover Specifications

Appendix G: Estimates of Probable Cost

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Appendix J: Rainfall-Runoff and Outflow Analysis

Appendix K: Drawdown Analysis

Appendix L: Percolation Analysis

Appendix M: Seepage Analysis

Appendix N: Santa Clara Valley Water District BMPs

Appendix A

Groundwater Data

PARIKH CONSULTANTS, INC.

Offices: Milpitas • Fremont • Sacramento • Walnut Creek
481 Valley Way, Bldg. 1, Milpitas, CA 95035-4016
(408) 945-1011 • Fax: (408) 945-1012

- *Geotechnical*
- *Environmental*
- *Materials Testing*
- *Construction Inspection*

Philip Williams & Associates
Consultants in Hydrology
770 Tamalpais Drive, Suite 401
Corte Madera, CA 94925

October 16, 2001
Job No. 99154.10

Attn: Mark Lindley

Sub: Los Capitancillos Freshwater Wetland Mitigation Project

Dear Mr. Lindley:

This letter presents the response to your memorandum, dated September 25, 2001. Based on this memorandum, PWA is requesting Parikh Consultants, Inc., to prepare a letter that presents the groundwater measurement data for the Los Capitancillos Freshwater Wetland Mitigation Project.

Accordingly, the groundwater data were compiled on the table that follows. Groundwater measurement operations started on May 26, 2000 and were terminated on August 22, 2001. Currently, there is a minimum of 15 readings per piezometer, per our scope of work.

Reading #	Date Monitored	B-1 (Installed 5/26/00)	B-2 (Installed 6/14/00)	B-3 (Installed 5/26/00)
1	05/26/2000	9	-	20.5
2	06/14/2000	9	9	9
3	07/20/2000	9.5	9.4	9
4	08/30/2000	9.9	9.8	9.4
5	09/27/2000	9.4	9.5	9.3
6	10/25/2000	9	9	8.8
7	11/30/2000	9.4	9.5	8.7
8	12/29/2000	9.3	8.9	8.7
9	01/23/2001	9.5	9.5	8.9
10	02/21/2001	8.1	7.9	8.3
11	03/21/2001	9	8.6	8.5
12	04/30/2001	9.6	9.2	8.9
13	05/22/2001	9.5	9.6	9.4
14	06/29/2001	10.6	10.2	9.6
15	07/23/2001	10.2	9.6	9.9
16	08/22/2001	10.5	9.7	9.7

Note: The numbers presented above are the measured depths (in feet) from the ground surface to the water table.

If you have any questions, please feel free to contact this office.

Very truly yours,
PARIKH CONSULTANTS, INC.

Apostolos V. Kozompoli.

Apostolos V. Kozompolis
Staff Engineer

Gary Parikh, P.E., G.E. 666
Project Manager

REGISTERED PROFESSIONAL ENGINEER
GAURANG R. PARIKH
No. 666
EXP. 12-31-01
GEOTECHNICAL
STATE OF CALIFORNIA

CC: Belinda Allen, Santa Clara Valley Water District

99154GW_DATA.doc {2A}

Appendix B

Geotechnical Report

GEOTECHNICAL ENGINEERING REPORT
LOS CAPITANCILLOS FRESHWATER
WETLAND MITIGATION PROJECT
SANTA CLARA VALLEY WATER DISTRICT
SANTA CLARA COUNTY, CALIFORNIA
FINAL REPORT

For

Philip Williams & Associates, Ltd.
770 Tamalpais Drive, Suite 401
Corte Madera, CA 94925

PARIKH CONSULTANTS, INC.
481 Valley Way, Milpitas, CA 95035
(408) 945-1011

December, 2000

Job No. 99154.10

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LOS CAPITANCILLOS FRESHWATER WETLAND MITIGATION PROJECT

SANTA CLARA VALLEY WATER DISTRICT

SANTA CLARA COUNTY, CALIFORNIA

FINAL REPORT

INTRODUCTION

This final report presents the results of our geotechnical engineering study for the proposed Los Capitancillos freshwater wetland mitigation project. The attached Plate 1, Project Location Map, shows the location of the project and the vicinity.

This report presents our understanding of the project, existing site conditions, purpose and scope of investigation followed by description of field exploration, geology at the site, seismicity, our interpretation of the subsurface conditions, and our findings and recommendations for the Los Capitancillos freshwater wetland mitigation project. A draft report was submitted in July 2000. Review comments were received from SCVWD and response was presented for their concurrence. This report incorporates the response and clarification.

PURPOSE AND SCOPE

The purpose of this investigation was to evaluate the general subsurface conditions at the project site, to evaluate their engineering properties and to evaluate the site for the design of the Los Capitancillos freshwater wetland mitigation project. The main Geotechnical concerns for this project are potential loss of water by percolation from the wetland area, the stability of excavation slopes and potential settlement of fill areas.

The scope of work performed for this investigation included review of the available soils and geologic literature pertaining to the site; obtaining representative samples and logging soil materials encountered in four exploratory borings and six test pits; performing in-situ percolation tests in the test borings; laboratory testing of the collected samples; engineering analyses of the field and laboratory data; and preparation of this report. A detailed scope of work is outlined in our proposal to Philip Williams & Associates, Ltd., dated February 9, 2000.

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the subsurface conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain a properly constructed project.

SITE CONDITIONS

The proposed wetland will be constructed on a District-owned parcel located on the south side of Guadalupe Creek, north side of Coleman Road and Oak Canyon Place, and about 2000 feet east of Camden Avenue. Further south, an urban residential neighborhood bounds the historically wider floodplain. The wetland mitigation site is a relatively flat parcel of land that is presently covered with weeds, grass and bushes.

A set of PG&E power lines pass over the southern side of the site in an east-west orientation. PG&E holds a 165-foot wide tower line easement on the site along the power line alignment. This easement may affect the project's use of this portion of the site. In addition, the underground Almaden Valley Pipeline passes through the same area of the site, and has a 30-foot wide associated easement held by the District. A 20-foot wide storm drain easement extends across the southwestern portion of the site.

PROPOSED CONSTRUCTION

The overall goal for the Los Capitancillos Freshwater Wetland Mitigation Project is to create the maximum acreage of new U.S. Army Corp of Engineers (USACE) jurisdictional area with the highest potential habitat values for wildlife. The wetland will be constructed on a Santa Clara Valley Water District (District)-owned parcel located on the south side of Guadalupe Creek, north side of Coleman Road and Oak Canyon Place, and about 2000 feet east of Camden Avenue. The specific goal of the project is to provide 0.6 acres of freshwater wetland mitigation required for the District's 1997 Urgent Sediment Removal Project and provide additional wetland acreage to be used to mitigate for anticipated future wetland impacts.

The proposed wetland will consist of wetland basins including a sedimentation area. Fresh water for the proposed mitigation project will be supplied from the District's Almaden Valley pipeline located to the southwest end of the site.

Approximately four to six feet deep excavations with side slopes of about 2H: 1V are anticipated during wetland basin construction. Excavated materials may be used to build a low dike around the wetland area to increase the basin capacity.

FIELD EXPLORATION AND LABORATORY TESTING

Based on our scope of work and the discussions with the project team, four borings were drilled to a depth of 30 feet (May 26 and June 14, 2000) and 6 test pits up to maximum depth of eight feet (May 25, 2000) below the existing ground surface. The boring and pit locations were judiciously placed at the time of our investigation, and are presented on Plate 2, Site Plan. In addition, three monitoring wells were installed after completion of drilling at three of the borings

(B-1, B-2 and B-3), and two percolation tests were performed in order to estimate the soil permeability (B-2 and B-4).

The test borings were advanced with a truck-mounted drill rig using a 203 mm (8 inches) diameter hollow stem auger. The borings were drilled under the technical supervision of one of our engineers, who classified and continuously logged the soils encountered during drilling and supervised the collection of soil samples at various depths for visual examination and laboratory testing. The soil samples were obtained during drilling by driving a 64 mm (2.5 inches) I.D. Modified California sampler or a 35 mm (1.4 inches) I.D. Standard Penetration Test sampler into the subsurface soils under the impact of a 63.6 kg (140 pound) hammer falling through 76 cm (30 inches). The blow counts required to drive the sampler for the last 30 cm (12 inches) are presented on the "Log of Borings", Appendix A. After visual examination, the collected samples were sealed and transported to our laboratory for further evaluation and testing. The description of the soils encountered and relevant boring information is presented on the Logs of Borings, Appendix A.

The test pits were performed with a backhoe. The soil profile was vertically logged and is presented in a Log of Boring format. Samples were collected at selected depths, and transported to our laboratory for further evaluation and testing.

As directed by the SCVWD, additional samples were collected at previously selected depths for the environmental study. Totally 20 samples were collected. Two samples were collected from two of the test pits (PT-1 and PT-4), at six inches and four feet depth. These samples were collected using a scoop in a plastic bag (liner), and were stored in 1.9-inch I.D. steel sleeves. Plastic end caps and tape were used to seal the samples in the steel sleeves. The sleeves were then put in a “zip-loc” bag. Labels were used for both the sleeves and the “zip-loc” bags. An icebox was used for field storage and transportation to the Sequoia Analytical laboratory as directed by SCVWD.

In addition, four samples were collected from each one of the four borings, at six inches, two, four and eight feet depth. The samples were collected via a standard splitspoon sampler. Due to the presence of gravels and cobbles in the area explored, and due to the fact that the soil was dry at the upper eight feet, intact samples could not be obtained. These samples were collected with the same method described above using plastic liners and steel sleeves. It should be mentioned that the soil collection tools used (scoop and split spoon sampler) were not steam cleaned between each sampling, since our field exploration program was not set up for this purpose. These samples were delivered to Sequoia Analytical Laboratory by the end of each exploration day for environmental laboratory testing.

Laboratory tests performed for the geotechnical study include the following: Laboratory determination of Moisture (ASTM Test Method D 2216-92), Atterberg Limits (ASTM Test Method D 4318-93) and Grain Size Distribution (ASTM Test Method D 422-63). The laboratory test methods and results are presented in Appendix B.

The logs presented in this report were prepared from the field logs, which were edited after visual re-examination of the soil samples in the laboratory, and results of classification tests on selected soil samples as indicated on the logs. The abrupt stratum changes shown on these logs may be gradational and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations.

GEOLOGY

The project site is in the southeastern portion of the San Francisco Bay area in the Coast Range geomorphic province of California. The Coast Range forms a nearly continuous topographic barrier between the California coastline and the San Joaquin Valley. In general, the Coast Range in this region is a double chain of mountain running north-northwest. Between the two chains of mountain lies the basin of San Francisco Bay, including the valleys at the end of the Bay, Petaluma on the north and Santa Clara on the south. Three prominent geologic blocks dominate the San Francisco Bay Area: the Santa Cruz Mountains (western block), the San Francisco Bay (central block), and the East Bay Hills/Diablo range (eastern block).

The general geology in the site vicinity was mainly studied from geologic maps compiled by E.J. Helley and E.E. Brabb (1971), (see attached Plate 3, Geologic Map). The surficial geologic units in the site vicinity were deposited during Late Cenozoic Periods. The older units generally occupy higher elevations. The oldest unit mapped by them is Santa Clara Formation (QTs) which is composed of poorly consolidated conglomerate, sandstone, siltstone, and claystone of Pliocene and Pleistocene age, with minor lignite deposits. Relatively younger units i.e. Fluvial Deposits at the outer edge of young alluvial funs (Qyfo), Young Alluvial Fan Deposits (Qyf), and Older Fan Deposits (Qof) which mainly consist of alluvial and fluvial deposits are mapped within the project vicinity.

The project site, adjacent to Guadalupe Creek, is within a broad alluvial plain situated between the northern ridges of the Santa Cruz Mountains to the south and the lower basin of the Santa Clara Valley to the north. The headwaters of the watershed upstream of the project site (maximum elevation 3486 feet) originate in steep hill slopes (~35% slope) comprised of erodible and fractured sedimentary rocks of the Franciscan Complex. Northeast-flowing tributaries such as Pheasant Creek are captured by the larger trunk stream (Guadalupe Creek), which flows northwestward along a linear valley following the trace of the Berrocal Fault Zone. Guadalupe Creek emerges from this mountainous zone onto the alluvial plain, comprised of Late Pleistocene alluvium, through a gap between the Blossom Hill and Capitancillos ridges. In a general sense, the project site is located in a transitional geomorphic zone where stream gradient and sediment grain size decrease in the downstream direction.

SUBSURFACE CONDITIONS

Based on the boring and pit data, the site is generally underlain by a layer of very stiff to hard sandy lean clay with gravel, sandy silt and silty sand, having a thickness of 1.5 to 3.5 feet. This layer is underlain by native weakly cemented gravels and cobbles, containing sand and clay matrix. These deposits are medium dense to very dense, extending throughout the explored depth of 31 feet. They typically contain well-graded to poorly-graded gravels and cobbles with sand, clay and silt. Occasional interbedded layers of sandy lean clay and clayey sand were encountered. Artificial fill was encountered at the northeast corner of the project site.

Groundwater was encountered in all borings during drilling at about nine feet depth, except boring B-3 in which ground water was measured at 20.5 feet during drilling. It is anticipated that groundwater level will fluctuate with the passage of time due to seasonal groundwater fluctuations, changes in creek flow, surface and subsurface flow, ground surface run-off and other factors that were not existent at the time of investigation.

Piezometers were installed at B-1, B-2 and B-3 after drilling was completed, in order to measure the groundwater level in a more stable condition.. Groundwater level was measured to be at nine feet depth in the piezometers at B-1 and B-3 on June 14, 2000. B-2 was drilled on June 14, 2000 and the ground water level was also measured at nine feet depth. This depth roughly coincides with the creek elevation. Subsequent water level measurements are being taken in a monthly basis and are presented in this report (Appendix E).

Detailed descriptions of the materials encountered in the exploratory borings are presented in Appendix A, "Log of Borings". It should be noted that these descriptions and related information depict subsurface conditions only at the locations indicated on the logs and on the particular date noted on the logs. Because of the variability from place to place within soil/rock in general, subsurface conditions at other locations may differ from conditions occurring at the locations explored.

EARTHQUAKE CONSIDERATIONS

Seismic Sources

No structures are proposed for this project. However, the following site data is provided as project information. The project site is located within a seismically active region. A Fault Map showing the site location relative to the major active faults in the Bay Area is presented in Plate 4. Significant earthquakes that have occurred in this area are generally associated with crustal movements along well-defined active fault zones. Faults in the vicinity of the site with a moderate to high potential for producing strong shaking at the site include the San Andreas Fault, the Calaveras Pacines San Benito Fault, the Hayward and the Monte Vista Fault systems.

The Maximum credible earthquake magnitudes for some of the major faults in the area determined by Mualchin (California Seismic Hazard Map 1996) are summarized below. These maximum credible earthquake magnitudes represent the largest earthquakes that could occur on the given fault based on the current understanding of the regional tectonic structure.

Fault	Estimated Distance From Project Site	Maximum Credible Earthquake
Hayward Fault (HWD)	14 km	7.5
Calaveras Pacines San Benito Fault (CPS)	18 km	7.5
San Andreas Fault (SAN)	13 km	8.0
Monte Vista (MVE/MVW)	2 km	6.5

Based on the California Seismic Hazard Map by Caltrans (Mualchin, 1996), the governing fault is the Monte Vista Fault (Mw = 6.5). Peak Bedrock Acceleration (PBA) was estimated to be 0.5g using the said reference, which is based on Maximum Credible Earthquake (MCE) and uses the attenuation curves by Mualchin and Jones (1992).

1. Governing Fault = Monte Vista Fault (Mw=6.5)
2. Distance to Fault = 2 km
3. Peak Bedrock Acceleration = 0.5 g

Based on Caltrans Seismic Design Criteria (Version 1.1, July 1999) ARS Curves for Soil Profile D (Figure B.7), Peak Ground Surface Acceleration (PGA) on the site is in the order of 0.5g.

Seismic Hazards/Liquefaction Potential

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking, and liquefaction. Since no active faults pass through the site, the potential for fault rupture is relatively low. Based on available geological and seismic data, the possibility of the site to experience strong ground shaking may be considered high.

Liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged cohesionless sands and silts of low relative density are the type of soils that usually are susceptible to liquefaction. Based on the investigation, the majority of the site subsurface soils do not meet these criteria. Therefore, liquefaction potential of the project site is low.

FINDINGS AND RECOMMENDATIONS

General

Based on the findings of our investigation, it is our opinion that the proposed Los Capitancillos freshwater wetland mitigation project is feasible from a geotechnical standpoint provided the recommendations presented in this report are incorporated into the final design and construction.

This report was prepared specifically for the proposed project. Normal construction procedures were assumed throughout our analysis and represent one of the bases for recommendations presented herein. Our design criteria have been based upon the materials and conditions encountered in the borings. Therefore, we should be notified in the event that these conditions are changed, so as to modify or amend our recommendations.

Stability

Approximately four to six feet deep excavations with side slopes of about 2H:1V are anticipated during wetland basin construction. Excavated materials may be used to build a low dike around the wetland area to increase the basin capacity. Based on the slope stability evaluation conducted for the side slopes using the computer program PCSTABL, it appears that 2H:1V slopes up to a maximum height of 20 feet should be feasible.

It should be noted that the factor of safety obtained from a slope stability calculation is a relative term and is derived from evaluating the ratio of the disturbing forces to the resisting forces in the soil mass. Also, the safety factor has been evaluated under certain prescribed conditions such as potential seismic forces, saturated soil shear strengths, steepness of the slope, etc. The safety factors will vary with variations in the prescribed conditions. Therefore, the safety factors are to be considered as relative terms. Currently, no universal standards for acceptable safety factors are established in the geotechnical engineering profession. From our experience, a safety factor of 1.5 under static conditions is considered to be "relatively safe" and generally acceptable. A safety factor of less than 1.0 indicates a potentially unstable slope which may fail if all the specific conditions exist.

Pseudostatic analyses were developed in order to evaluate slope stability under seismic loading. For slope stability analyses purposes a typical input value for peak ground surface acceleration (PGA) would be in the range of 0.1 to 0.2 g. (pseudo-static analysis). According to Caltrans Guidelines for Foundation Investigation and Reports (May 2000), "Pseudo-static analyses shall use a seismic coefficient equal to one-half the horizontal ground acceleration. The effects of vertical acceleration may be omitted. Sites with a pseudo-static factor of safety equal to or greater than 1.0 shall be considered to have adequate stability and require no further stability analysis". Accordingly, initially we performed the slope stability analyses using a seismic coefficient of 0.12g, which is a typical value. In addition, we considered a maximum seismic coefficient of 0.20g.

During soil investigation on sands and gravels intact samples are very difficult to obtain and test properly, therefore sophisticated shear strength tests (unconfined compression, UU/CU TX tests) are usually impractical. However, for simple problems, the angle of internal friction can be satisfactorily approximated by correlation with penetration resistance and soil classification. This technique was adopted for the selection of the soil strength parameters for the slope stability analyses.

Since sands and gravels dominate the project site, drained conditions will occur, and no distinction was considered for short versus long-term loading conditions.

The safety factors obtained from our analyses are summarized bellow. The computer outputs are presented on Appendix C, and they contain the slope geometry and the strength parameters used.

Static case: SF = 2.58
Pseudo-static case (PGA=0.12): SF = 1.90
Pseudo-static case (PGA=0.20): SF = 1.44

Settlement

The soil conditions at the site are generally dense gravel and cobbles with sand and silts. Settlements due to construction of the wetlands basin were estimated to be negligible for the nature of this project.

Hydraulic Conductivity/Seepage

We conducted falling head field percolation tests in two of the soil borings (B-2 and B-4) on June 14, 2000. In the beginning of the tests (t=0) the water in the borings was at ground level. Thereafter, the water drawdown was recorded at regular time intervals. The results of these tests are summarized in the following table.

Field Percolation Test Results

B-2 (8" diameter)		B-4 (8" diameter)	
Time elapsed (min)	**Drawdown (ft)**	**Time elapsed (min)**	**Drawdown (ft)**
0	0	0	0
1	1.5	1	0.8
2	2.7	2	1.0
3	4.8	3	1.3
4	5.8	4	1.4
6	6.7	5	1.45
8	7.4	10	1.8
13	8.5	15	1.95
18	8.8	25	2.0
28	8.8	35	2.0
38	8.8	45	2.0
48	8.8	75	2.2
78	8.8	105	2.4
108	8.8	135	2.5
		195	2.7
		255	2.9
		375	3.5

The primary purpose in performing these tests was to get a broad based (qualitative) range of permeability of the subsurface soils on the project site. It should be recognized that these field percolation tests cannot provide a quantitative value of the actual permeability. However, it does provide an order of magnitude of field percolation rate.

In addition, we used published data that correlate hydraulic conductivity to characteristic grain size (D_{10}, D_{50}) for different sediment types (Shepherd 1989, Terzaghi and Peck 1967). The laboratory soil gradation test results were used for this purpose. Based on our evaluation, the soils in the upper ten feet (approximate impacted zone) appear to be highly permeable. We estimate the hydraulic conductibity to range from 0.01 cm/s in areas predominantly consisting of sands to 200 cm/s in areas where gravels and cobbles were encountered.

Potential loss of water by percolation from the wetland basin area is a major concern for the project. Percolation rate may be relatively high because of the highly permeable soils in the upper ten feet. If the percolation rate and water loss is a concern, we recommend that a compacted clay liner be constructed over the basin area. Typically, a compacted clay liner, if constructed properly, yields a hydraulic conductivity of 0.00001 cm/s or less, which will reduce the seepage rate to acceptable levels.

At this time the project criteria for recharge or retention in the proposed basin are not defined. Also, we do not know if a manufactured liner with the on-site soil will be used for controlling seepage. This will depend on the overall program for retention, recharge, revegetation, or other soil cap functions. Specific laboratory testing and analysis may be required if on-site soil is to be used for liner material.

Plan Review

We recommend that final plans for foundations be reviewed by this office prior to construction so that the intent of our recommendations is included in the project plans and specifications and to further see that no misunderstandings or misinterpretations have occurred.

Construction Observation

To a degree, the performance of any structure is dependent upon construction procedures and quality. Hence, density testing of subgrade should be carried out by the regulating agencies. Any subsurface conditions different from those forming the basis of our recommendations should be forwarded to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our field exploration and the assumption that the soil conditions do not deviate from observed conditions. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings. The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our conclusions and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

The findings in this report are valid as of the present date. However, changes in the soil conditions can occur with the passage of time, whether they be due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

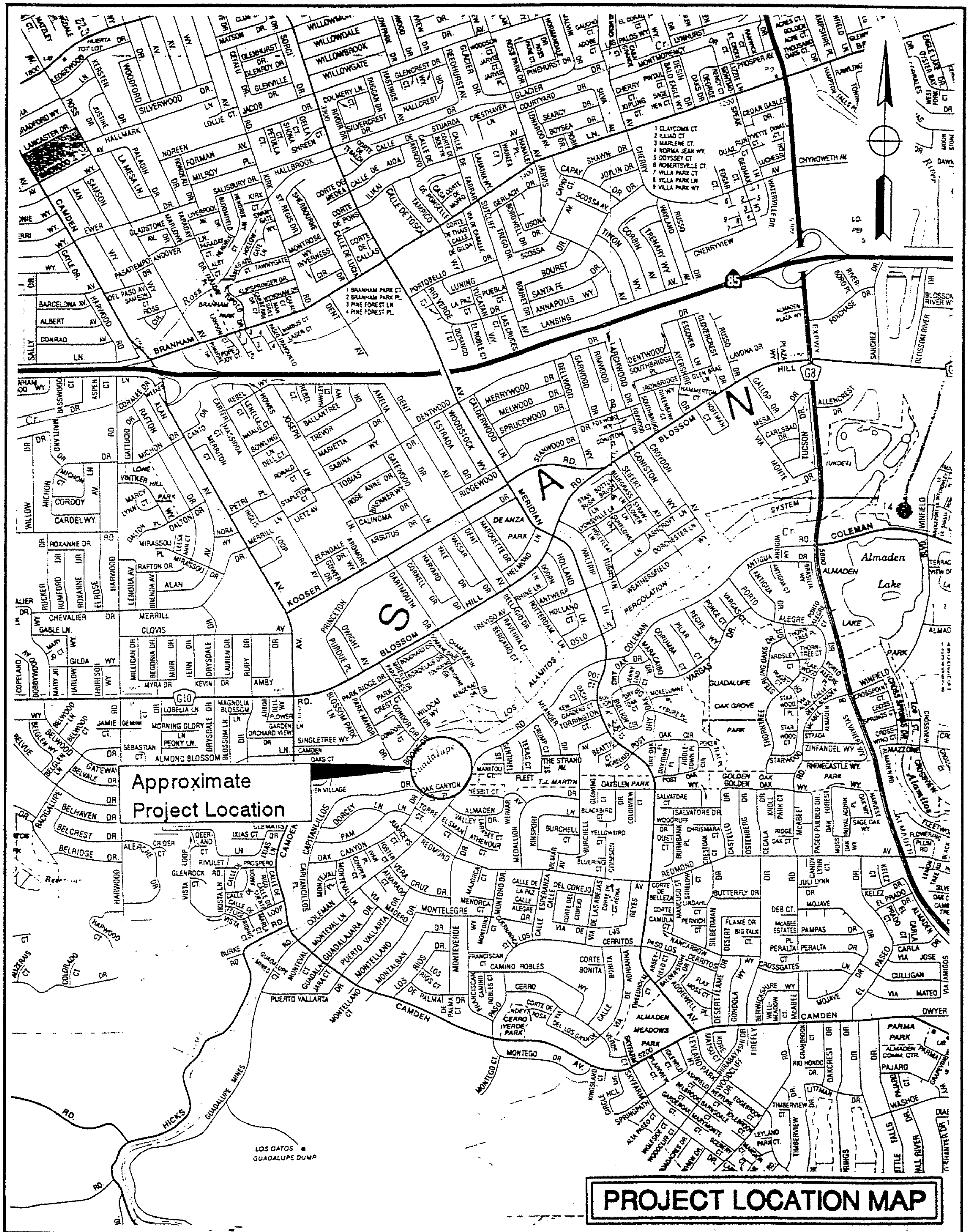
Respectfully Submitted,
PARIKH CONSULTANTS, INC.

Gary Parikh, G.E. #666
Project Manager

REGISTERED PROFESSIONAL ENGINEER
GAURANG R. PARIKH
No. 666
EXP. 12-31-01
GEOTECHNICAL
STATE OF CALIFORNIA

99154(IN)

APPENDIX A



PROJECT LOCATION MAP

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

LOS CAPITANCILLOS WETLANDS PROJECT
SAN JOSE, CALIFORNIA

JOB NO.: 99154.10

PLATE NO: 1

Los Capitancillos Wetland Mitigation Site

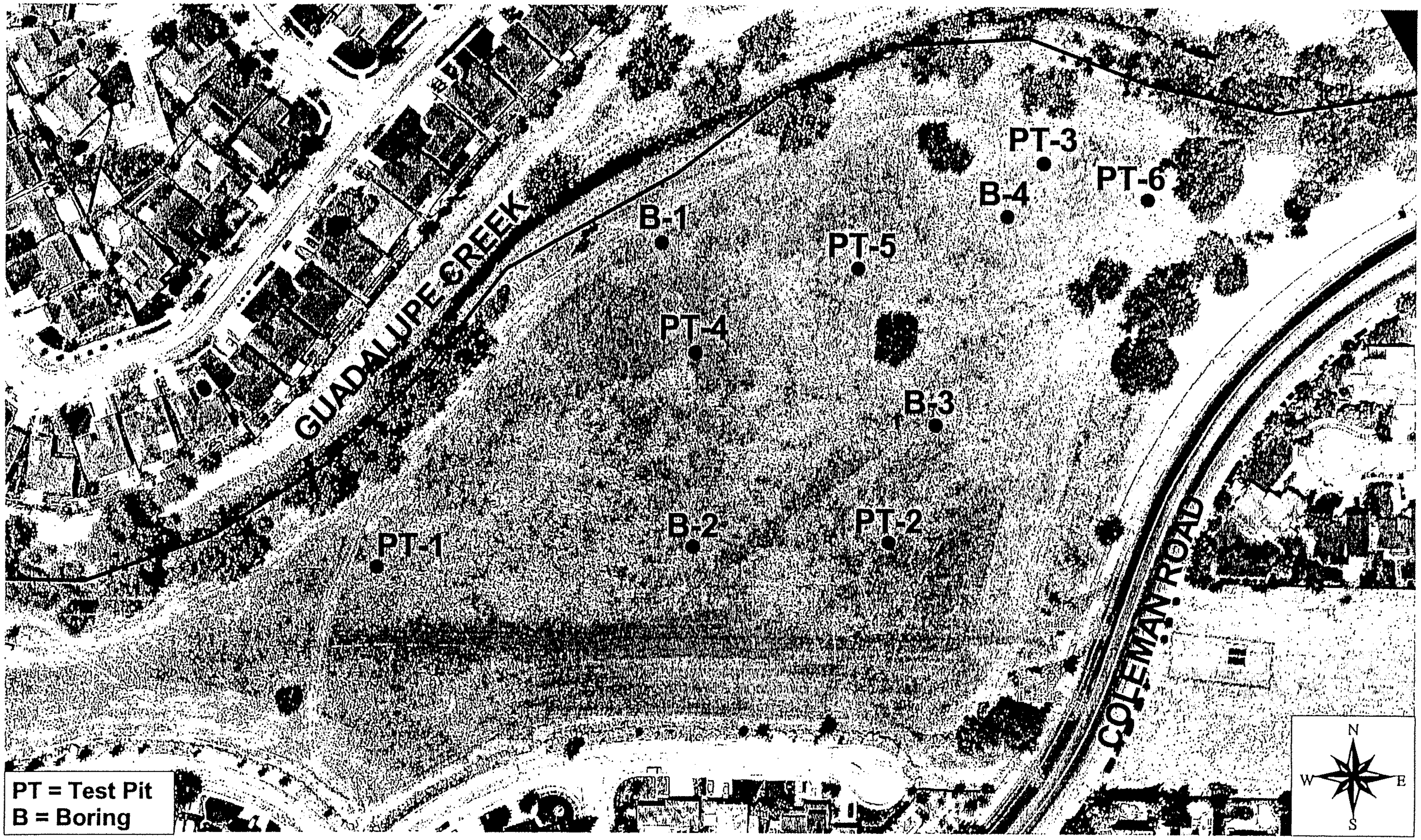
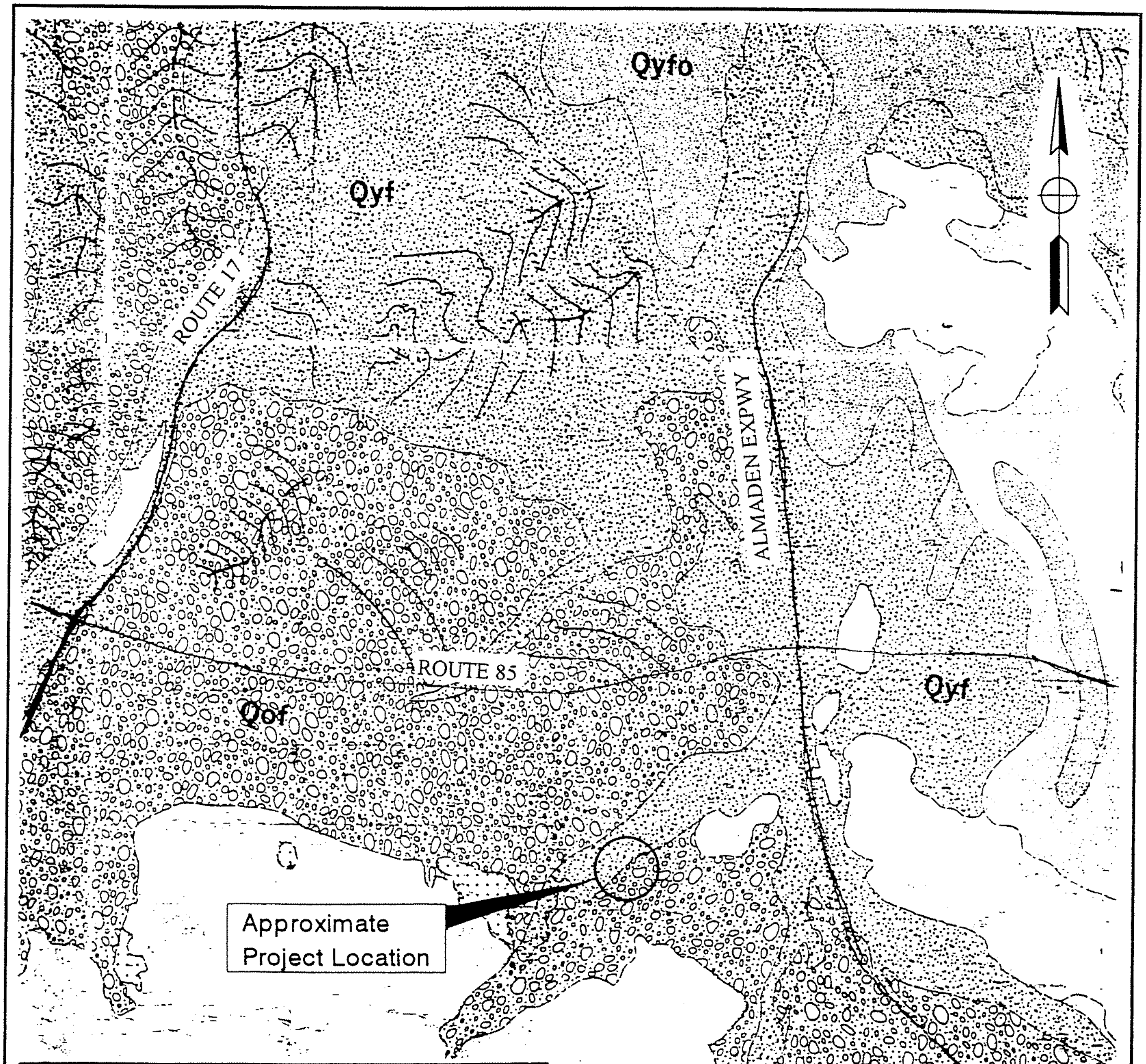


PLATE NO. 2: SITE PLAN

Santa Clara Valley Water District



LEGEND:

Qyfo -	Fluvial deposits at the outer edge of young alluvial fans (Qyf); forms levees between basin deposits (Qb) and characterized by variable grain size. Mainly fine sand, silt and silty clay.
Qyf -	Young alluvial fan deposits grading headward to terrace and levee deposits of channels incised in Qof. Consists of moderately well sorted fine sand and silt with minor gravel beds becoming more abundant toward fan heads.
Qof -	Older fan deposits bordering uplands; at fan heads incised by channels partly filled by Qyf; at outer margins overlapped by younger alluvial fan deposits; Qyf, Qyfo and Qb. Mainly coarse sand and gravel with local accumulations of middle and late Pleistocene vertebrate fossils.

GEOLOGIC MAP

Source: Geologic map of the late cenozoic deposits, Santa Clara County, California, by E.J. Helley and E.E. Brabb, 1971, USGS Map MF-335, Sheet 1 of 3, SCALE 1:62,500

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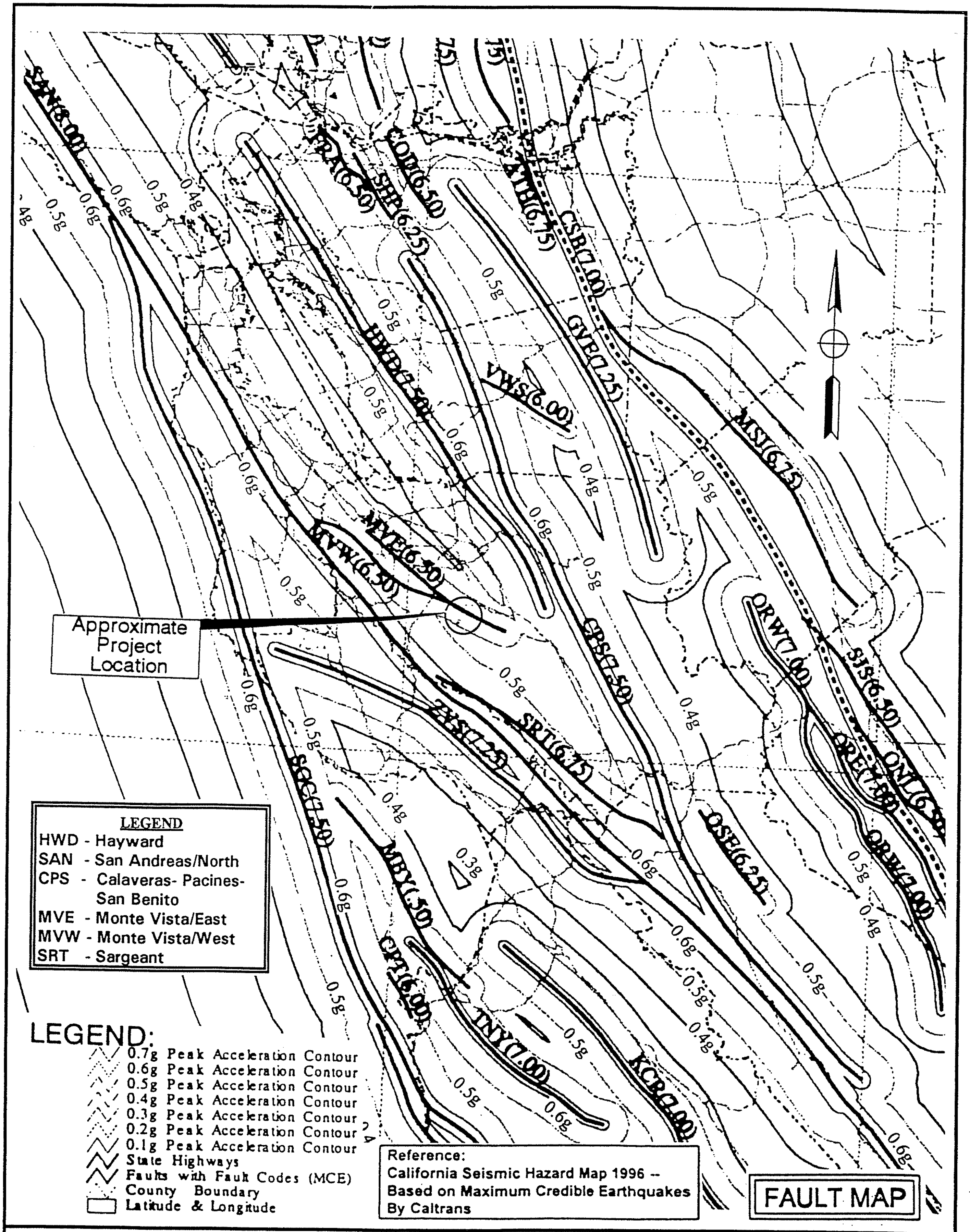
MATERIALS ENGINEERING

LOS CAPITANCILLOS WETLANDS PROJECT
SAN JOSE, CALIFORNIA

JOB NO.: 99154.10

PLATE NO: 3



Reference:
California Seismic Hazard Map 1996 --
Based on Maximum Credible Earthquakes
By Caltrans

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MATERIALS ENGINEERING

LOS CAPITANCILLOS WETLANDS PROJECTS
SAN JOSE, CALIFORNIA

JOB NO.: 99154.10

PLATE NO: 4

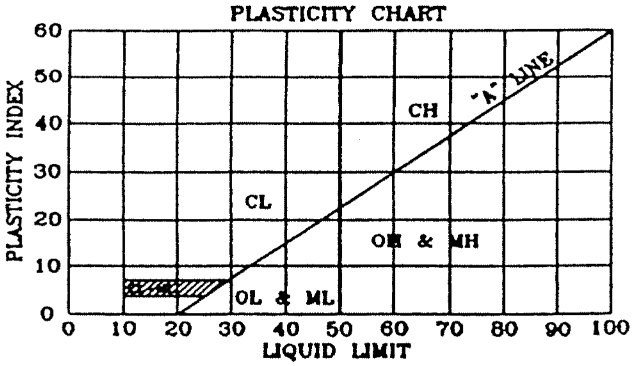
UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	ILLUSTRATIVE GROUP NAMES
COARSE-GRAINED SOILS More than 50% retained on No. 200 sieve	GRAVELS More than 50% of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS Less than 5% fines	GW	Well graded gravel, Well graded gravel with sand
			GP	Poorly graded gravel, Poorly graded gravel with sand
		GRAVELS WITH FINES More than 12% fines	GM	Silty gravel, Silty gravel with sand
			GC	Clayey gravel, Clayey gravel with sand
	SANDS 50% or more of coarse fraction passing No. 4 sieve	CLEAN SANDS Less than 5% fines	SW	Well graded sand, Well graded sand with gravel
			SP	Poorly graded sand, Poorly graded sand with gravel
		SANDS WITH FINES More than 12% fines	SM	Silty sand, Silty sand with gravel
			SC	Clayey sand, Clayey sand with gravel
FINE-GRAINED SOILS 50% or more passing No. 200 sieve	SILTS AND CLAYS Liquid Limit less than 50%		ML	Silt, Sandy silt with gravel
			CL	Lean clay, Sandy lean clay with gravel
			OL	Organic clay, Sandy organic clay with gravel
	SILTS AND CLAYS Liquid Limit more than 50%		MH	Elastic silt, Sandy elastic silt with gravel
			CH	Fat clay, Sandy fat clay with gravel
			OH	Organic clay, Sandy organic clay with gravel
HIGHLY ORGANIC			PT	Peat, Highly organic silts

NOTE: 1. Coarse-grained soils receive dual symbols if: (a) their fines are CL-ML (e.g. SC-SM or GC-GM) or (b) they contain 5-12% fines (e.g. SW-SM, GP-GC, etc.). Fine-grained soils receive dual symbols if their limits plot in the hatched zone of the Plasticity Chart (CL-ML).

2. The table lists 30 out of a possible 110 Group Names, all of which are assigned to unique proportions of the constituent soils. Flow charts in ASTM D 2487-93 aid assignment of the Group Names.

PLASTICITY CHART



GRAIN SIZE CLASSIFICATION

CLASSIFICATION	US STANDARD SIEVE SIZE
BOULDERS	Above 12"
COBBLES	12" to 3"
GRAVEL Coarse Fine	3" to 3/4" 3/4" to No. 4
SAND Coarse Medium Fine	No. 4 to No. 10 No. 10 to No. 40 No. 40 to No.200
SILT & CLAY	Below No. 200

COHESIVE SOIL CONSISTENCY

CLASSIFICATION	UNCONFINED COMP. STRENGTH (psf)
Very Soft	< 500
Soft	500 - 1000
Medium(Firm)	1000 - 2000
Stiff	2000 - 4000
Very Stiff	4000 - 8000
Hard	> 8000

COHESIONLESS SOIL RELATIVE DENSITY

CLASSIFICATION	SPT BLOW COUNTS (Blows/ft)
Very Loose	< 4
Loose	5 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	> 50

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LOS CAPITANCILLOS WETLANDS PROJECT
SAN JOSE, CALIFORNIA

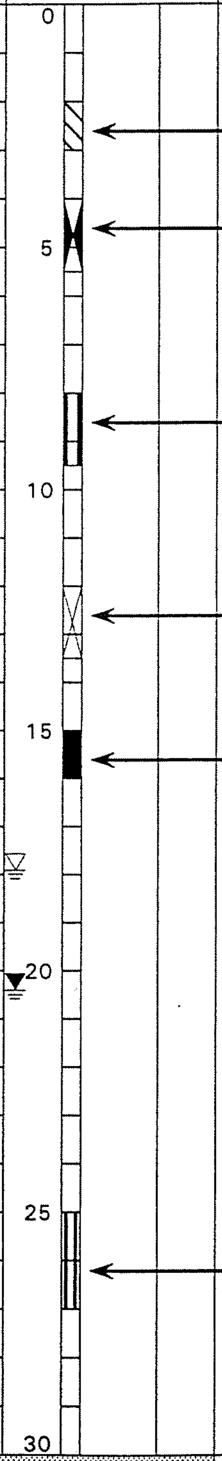
JOB NO.: 99154.10

PLATE NO: A-1A

Boring Location, Elevation & Date Drilled:	Drilling Method:	BORING NUMBER **LEGEND**
	Sampling Method:	Sheet 1 of 2

Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)
1			22	
2	110	12	23	1.2
3	98	28	100 psi	0.8
4	-	10	35	-
5	95	20		0.7
6	-	-		12.0

Depth (ft) Soil Graph & U.S.C.S.



Compressive strength as measured by Pocket Penetrometer, in tsf. → pp = 1.0tsf

← 2 inch I.D. California Sampler (C).

← 2-1/2 inch I.D. Modified California Sampler (MC).

← 3.5-inch I.D. Pitcher Tube Sampler (Cored).

← 1-3/8 inch I.D. Standard Splitspoon Sampler (SPT).

← 1.9 inch I.D. Hand Sampler driven with a slide hammer.

Groundwater level first encountered during drilling

Groundwater level at completion of boring

Liquid Limit (LL), in percent → LL=30
Plasticity Index (PI), in percent → PI=10

← NX Core.

Percent gravel and coarser in sample,(+#4) → +#4=20%
Percent fines (silt/clay) in sample, (-#200) → -#200=50%

LEGEND FOR LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

LOS CAPITANCILLOS WETLANDS PROJECT
SAN JOSE, CALIFORNIA

Date: 06/00

Job No.: 99154.10

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Plate: A-1B

LEGEND LEGEN 6-9-00

Boring Location, Elevation & Date Drilled:	Drilling Method:	BORING NUMBER **LEGEND**
	Sampling Method:	Sheet 2 of 2

Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)	Depth (ft) Soil Graph & U.S.C.S.		
					30	Direct Shear Test	DS
					35		
					40		
					45		
					50		
					55		
					60		

LEGEND FOR LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

LOS CAPITANCILLOS WETLANDS PROJECT
SAN JOSE, CALIFORNIA

Date: 06/00

Job No.: 99154.10

Plate: A-1B

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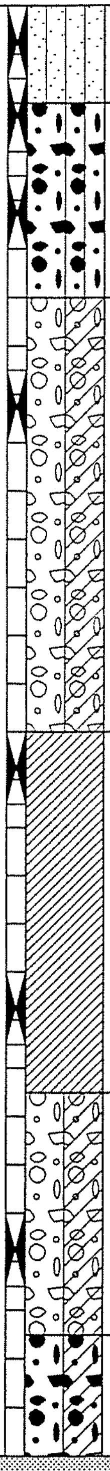
Boring Location, Elevation & Date Drilled:
SEE ATTACHED SITE PLAN; Elev. approx. 245.3 ft.; drilled on 5-26-00

Drilling Method:
8-inch dia. Hollow-stem auger
Mobile B-53

BORING NUMBER
B-1

Sampling Method:
2 1/2" I.D. Mod. Cal. (MC)/2" I.D. Cal. (C)/1 3/8" I.D. Std. Pen., 140 lbs hammer, 30 inch drop.

Sheet 1 of 2



Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)	Depth (ft)	U.S.C.S.		
MC-1	-	10	18		0	SM	SILTY SAND (SM), loose, dark brown, moist, fine grained sand, trace subangular to subrounded gravel up to 1", roots	
MC-2	-	3	30					
						GP GM	POORLY-GRADED GRAVEL WITH SILT AND SAND (GP-GM), medium dense, brown/gray, damp, subangular to subrounded up to 1.5", fine to coarse grained sand, trace pieces of cobbles	+#4=71% -#200=6%
MC-3	-	3	95					
					5		Dense, moist	
						GW GC	Gravel and cobbles increasing, 3" piece of cobble at cutttings	
MC-4	-	10	44				WELL-GRADED GRAVEL WITH CLAY AND SAND (GW-GC), medium dense, brown/gray, moist to wet, subangular to subrounded up to 2", medium to coarse grained sand, trace fine grained sand, pieces of cobbles	+#4=65% -#200=5%
					▽			
					10			
							Very hard drilling between 12 and 15 feet, gravel and cobbles	
MC-5	-	23	50		15	CL	SANDY LEAN CLAY (CL), hard, mottled light greenish gray/brown/dark brown, moist, very fine grained sand, trace subrounded gravel up to 1", pieces of yellow and red slightly cemented sandstone	
MC-6	-	20	50		20		Hard, trace coarse sand and fine subrounded gravel up to 3/8", pockets of fine clayey sand	+#4=3% -#200=66%
						GW GC	Hard drilling between 22.5 and 24.5 feet	
MC-7	-	10	91		25		WELL-GRADED GRAVEL WITH CLAY AND SAND (GW-GC), dense, brown/gray, wet, subrounded to subangular up to 2", mainly coarse grained sand, some fine/medium grained, pieces of cobbles	
						GP GC		
					30			

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

LOS CAPITANCILLOS WETLANDS PROJECT
SAN JOSE, CALIFORNIA

Date: JULY 2000

Job No.: 99154.10

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate:
A-2A

LB 99154 6-9-00

Boring Location, Elevation & Date Drilled: SEE ATTACHED SITE PLAN; Elev. approx. 245.3 ft.; drilled on 5-26-00	**Drilling Method:** 8-inch dia. Hollow-stem auger Mobile B-53	**BORING NUMBER** **B-1**
	Sampling Method: 2 1/2" I.D. Mod. Cal. (MC)/2" I.D. Cal. (C)/1 3/8" I.D. Std. Pen., 140 lbs hammer, 30 inch drop.	Sheet 2 of 2

Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)	Depth (ft) Soil Graph & U.S.C.S.		
MC-8	-	8	50/4"		30 ▨	POORLY-GRADED GRAVEL WITH CLAY AND SAND (GP-GC), very dense, brown/gray, wet, subrounded to subangular up to 2", medium to coarse grained sand, trace fine grained, pieces of cobbles	+#4=72% -#200=9%
						Bottom of drillhole at 31 feet A 2.25" I.D. monitoring well was installed after completion of the boring Additional samples were collected at 6", 2', 4' and 8' for environmental study	
					35		
					40		
					45		
					50		
					55		
					60		

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

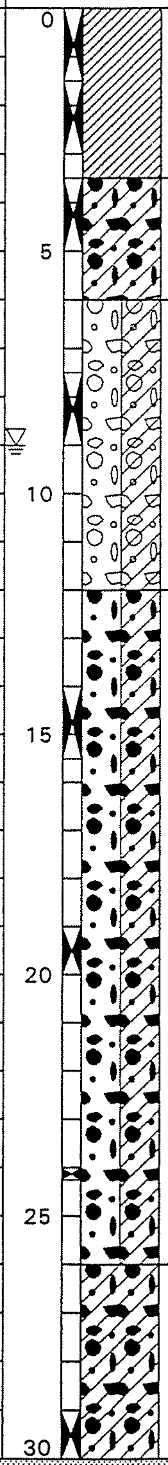
LOS CAPITANCILLOS WETLANDS PROJECT
SAN JOSE, CALIFORNIA

Date: JULY 2000	Job No.: 99154.10

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate:
A-2B

Boring Location, Elevation & Date Drilled: SEE ATTACHED SITE PLAN; Elev. approx. 246.3 ft.; drilled on 6-14-00	Drilling Method: 8-inch dia. Hollow-stem auger Mobile B-61	**BORING NUMBER** **B-2**
	Sampling Method: 2 1/2" I.D. Mod. Cal. (MC)/2" I.D. Cal. (C)/1 3/8" I.D. Std. Pen., 140 lbs hammer, 30 inch drop.	Sheet 1 of 2



Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)	Depth (ft)	U.S.C.S.	Description	
MC-1	-	8	39		0	CL	SANDY LEAN CLAY WITH GRAVEL (CL), very stiff, dark brown, damp, fine grained sand, subangular to subrounded gravel up to 0.75"	
MC-2	-	10	39				Very stiff	+#4=17% -#200=46%
MC-3	-	-	50/3"			GC	GRAVELLY LEAN CLAY WITH SAND (GC), hard, dark brown, moist, subangular to subrounded gravel up to 0.75", fine to coarse grained sand	
					5			
MC-4	-	7	56			GW GC	WELL-GRADED GRAVEL WITH CLAY AND SAND (GW-GC), medium dense, brown/gray, moist to wet, subangular to subrounded gravel up to 1.5", medium to coarse grained sand, trace fine grained sand and clay, pieces of cobbles, trace orange/reddish sand	+#4=52% -#200=9%
					10			
MC-5	-	13	75			GP GC	POORLY-GRADED GRAVEL WITH CLAY AND SAND (GP-GC), dense, brown/gray/orange, wet, subangular to subrounded gravel up to 1.5", medium to coarse grained sand, trace fine grained sand and clay, pieces of cobbles	
					15			
MC-6	-	12	50/6"		20		Dense	+#4=63% -#200=10%
							Pieces of gravel and cobbles	
MC-7	-	-	50/3"				Very dense (no recovery)	
					25			
						GC		
MC-8	-	7	95/11"		30		CLAYEY GRAVEL WITH SAND (GC), very dense, gray/brown/yellow, wet, subangular to subrounded	+#4=53% -#200=13%

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

LOS CAPITANCILLOS WETLANDS PROJECT
SAN JOSE, CALIFORNIA

Date: JULY 2000
Job No.: 99154.10

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Plate:
A-3A

LB 99154 6-9-00

Boring Location, Elevation & Date Drilled:	Drilling Method:	BORING NUMBER
SEE ATTACHED SITE PLAN; Elev. approx. 246.3 ft.; drilled on 6-14-00	8-inch dia. Hollow-stem auger Mobile B-61	B-2
	Sampling Method: 2 1/2" I.D. Mod. Cal. (MC)/2" I.D. Cal. (C)/1 3/8" I.D. Std. Pen., 140 lbs hammer, 30 inch drop.	Sheet 2 of 2

Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)	Depth (ft) Soil Graph & U.S.C.S.	
					30	gravel up to 1", fine to coarse grained sand, pockets of clay
						Bottom of borehole at 30.5 feet A 2.25" I.D. monitoring well was installed after completion of the boring Additional samples were collected at 6", 2', 4', 8' for environmental study
					35	
					40	
					45	
					50	
					55	
					60	

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

LOS CAPITANCILLOS WETLANDS PROJECT
SAN JOSE, CALIFORNIA

Date: JULY 2000

Job No.: 99154.10

Plate: A-3B

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Boring Location, Elevation & Date Drilled:
SEE ATTACHED SITE PLAN; Elev. approx. 244.0 ft.; drilled on 5-26-00

Drilling Method:
8-inch dia. Hollow-stem auger
Mobile B-53

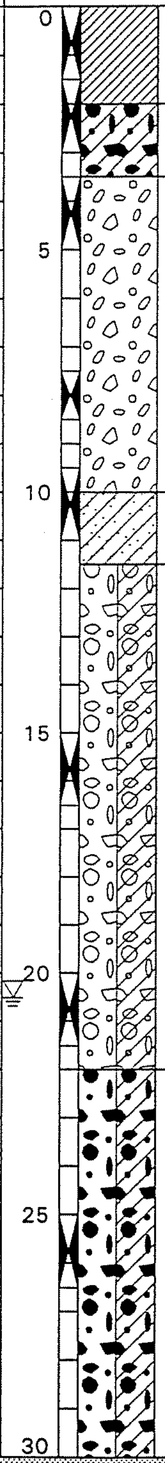
BORING NUMBER
B-3

Sampling Method:
2 1/2" I.D. Mod. Cal. (MC)/2" I.D. Cal. (C)/1 3/8" I.D. Std. Pen., 140 lbs hammer, 30 inch drop.

Sheet 1 of 2

Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)
MC-1	-	9	27	
MC-2	-	8	28	
MC-3	-	5	46	
MC-4	-	-	50/5"	
MC-5	-	10	55	
MC-6	-	7	85	
MC-7	-	8	100/10"	
MC-8	-	9	100/10"	

Depth (ft) Soil Graph & U.S.C.S.



U.S.C.S.	Description	
CL	SANDY LEAN CLAY (CL), very stiff, dark brown, moist, fine grained sand, some subangular to subrounded gravel up to 1", pieces of cobbles, trace yellow friable sandstone, roots	
GC	CLAYEY GRAVEL WITH SAND (GC), medium dense, brown, moist, subangular to subrounded up to 1.5", fine to medium grained sand	+#4=46% -#200=31%
	WELL-GRADED GRAVEL WITH SAND (GW), medium dense, mottlled gray/brown/orange, moist, subangular to subrounded up to 2", medium to coarse grained sand, pieces of cobbles, trace yellow friable sandstone Hard drilling between 6 and 10 feet, cobbles and boulders (no recovery)	
SC	CLAYEY SAND WITH GRAVEL (SC), medium dense, yellow/brown, moist, fine to coarse grained sand, subangular to subrounded gravel up to 1"	+#4=36% -#200=21%
GW GC	WELL-GRADED GRAVEL WITH CLAY AND SAND (GW-GC), dense, mottled brown/yellow/orange, moist, subangular to subrounded gravel up to 2", fine to medium grained sand, some coarse grained, pieces of cobbles Hard drilling between 16 and 20 feet Very dense, wet, subangular to rounded gravel up to 2", subrounded coarse grained sand, pieces of cobbles, pockets of yellow and orange friable sandstone	
GP GC	POORLY-GRADED GRAVEL WITH CLAY AND SAND (GP-GC), very dense, yellow/brown, wet, subrounded to well rounded gravel up to 2", pockets of fine to medium grained sand, trace dark red slightly cemented sandstone, pieces of cobbles	

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

LOS CAPITANCILLOS WETLANDS PROJECT
SAN JOSE, CALIFORNIA

Date: JULY 2000
Job No.: 99154.10

Plate: A-4A

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

LB 99154 6-12-00

Boring Location, Elevation & Date Drilled: SEE ATTACHED SITE PLAN; Elev. approx. 244.0 ft.; drilled on 5-26-00	Drilling Method: 8-inch dia. Hollow-stem auger Mobile B-53	**BORING NUMBER** **B-3**
	Sampling Method: 2 1/2" I.D. Mod. Cal. (MC)/2" I.D. Cal. (C)/1 3/8" I.D. Std. Pen., 140 lbs hammer, 30 inch drop.	Sheet 2 of 2

Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)	Depth (ft) Soil Graph & U.S.C.S.	
MC-9	-	11	61		30 ▨	Dense, subrounded to well rounded gravel up to 2", pockets of clayey sand, some coarse grained sand, pockets of yellow and purple cemented fine grained sand
						Bottom of drillhole at 31.5 feet A 2.25" I.D. monitoring well was installed after completion of the boring Additional samples were collected at 6", 2', 4' and 10' for environmental study
					35	
					40	
					45	
					50	
					55	
					60	

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

LOS CAPITANCILLOS WETLANDS PROJECT
SAN JOSE, CALIFORNIA

Date: JULY 2000

Job No.: 99154.10

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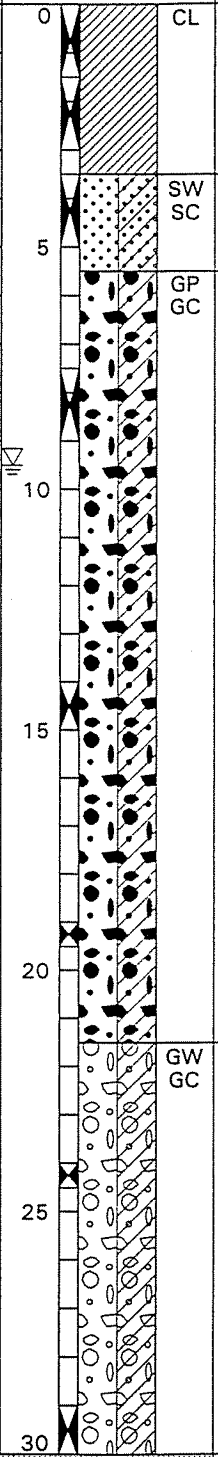
Plate: A-4B

Boring Location, Elevation & Date Drilled:	Drilling Method:	BORING NUMBER
SEE ATTACHED SITE PLAN; Elev. approx. 243.3 ft.; drilled on 6-14-00	8-inch dia. Hollow-stem auger Mobile B-61	**B-4**
	Sampling Method: 2 1/2" I.D. Mod. Cal. (MC)/2" I.D. Cal. (C)/1 3/8" I.D. Std. Pen., 140 lbs hammer, 30 inch drop.	Sheet 1 of 2

Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)
MC-1	-	5	62	
MC-2	-	3	30	
MC-3	-	3	33	
MC-4	-	4	66	
MC-5	-	12	50/5"	
MC-6	-	12	50/6"	
MC-7	-	13	50/5"	
MC-8	-	13	50/6"	

Depth (ft) Soil Graph & U.S.C.S.



Description	
SANDY LEAN CLAY WITH GRAVEL (CL), hard, dark brown, damp, fine to coarse grained sand, subangular to subrounded gravel up to 1" Very stiff, browm/gray	+#4=24% -#200=45%
WELL-GRADED SAND WITH CLAY AND GRAVEL (SW-SC), medium dense, brown/gray, damp, subangular to subrounded gravel up to 1.5", pieces of cobbles	+#$=46% -#200=6%
POORLY-GRADED GRAVEL WITH CLAY AND SAND (GP-GC), dense, gray/brown, moist to wet, subangular to subrounded up to 1", medium to coarse grained sand, trace fine grained sand and clay, pieces of cobbles, trace yellow/orange sand	
Very dense, wet, trace yellow cemented sand	+#4=45% -#200=11%
Very dense, wet	
WELL-GRADED GRAVEL WITH CLAY AND SAND (GW-GC), very dense, gray/brown, wet, subangular to subrounded up to 1.5", medium to coarse grained sand, trace fine grained sand and clay, pieces of cobbles	+#4=53% -#200=11%
Dense, gray/brown, trace orange/yellow sand and greenish sandstone	

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

LOS CAPITANCILLOS WETLANDS PROJECT
SAN JOSE, CALIFORNIA

Date: JULY 2000 Job No.: 99154.10

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Plate: A-5A

LB 99154 6-9-00

Boring Location, Elevation & Date Drilled: SEE ATTACHED SITE PLAN; Elev. approx. 243.3 ft.; drilled on 6-14-00	Drilling Method: 8-inch dia. Hollow-stem auger Mobile B-61	**BORING NUMBER** **B-4**
	Sampling Method: 2 1/2" I.D. Mod. Cal. (MC)/2" I.D. Cal. (C)/1 3/8" I.D. Std. Pen., 140 lbs hammer, 30 inch drop.	Sheet 2 of 2

Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)	Depth (ft) Soil Graph & U.S.C.S.	
					30	Bottom of borehole at 30 feet Additional samples were collected at 6", 2', 4' and 8' for environmental study
					35	
					40	
					45	
					50	
					55	
					60	

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

LOS CAPITANCILLOS WETLANDS PROJECT
SAN JOSE, CALIFORNIA

Date: JULY 2000

Job No.: 99154.10

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Plate: A-5B

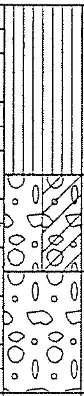
Test Pit Location, Elevation & Date Performed:
SEE ATTACHED SITE PLAN; Elev. approx. 248.5 ft.; performed on 5-25-00

Backhoe Test Pit

TEST PIT NUMBER
PT-1

Sampling Method:
Bulk Samples

Sheet 1 of 1



Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)	Depth (ft)	U.S.C.S.	Description	
					0	ML	SANDY SILT (ML), mottled dark brown/dark gray, moist, pockets of fine to medium grained sand, trace coarse sand and rounded to subangular gravel up to 3/8", trace roots	
1	-	11						
2	-	12						+#4 = 7% -#200 = 53%
						GW GC	Gravel increasing in size and content WELL-GRADED GRAVEL WITH CLAY, SAND AND COBBLES (GW-GC), dark brown/gray, moist, well rounded to subangular up to 3", medium to coarse grained sand, trace fine grained, cobbles up to 6", trace yellow slightly cemented sand,	
3	-	-			5			
						GW	WELL-GRADED GRAVEL WITH SAND AND COBBLES (GW), gray, moist, well-rounded to subrounded up to 3", coarse grained sand in pockets, trace medium/fine grained sand, subrounded cobbles up to 12" (27% cobbles, 54% gravel, 17% sand, 2% clay)	
4	-	-						
					10		Bottom of test pit at 8 feet No groundwater encountered Additional samples were collected at 6" and 4' for environmental study	
					15			
					20			
					25			
					30			

LOG OF TEST PIT

PARIKH CONSULTANTS, INC.
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LOS CAPITANCILLOS WETLANDS PROJECT
SAN JOSE, CALIFORNIA

Date: JULY 2000

Job No.: 99154.10

LB 99154 6-15-00

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Plate:
A-6

Test Pit Location, Elevation & Date Performed:
SEE ATTACHED SITE PLAN; Elev. approx. 244.5 ft.; performed on 5-25-00

Backhoe Test Pit

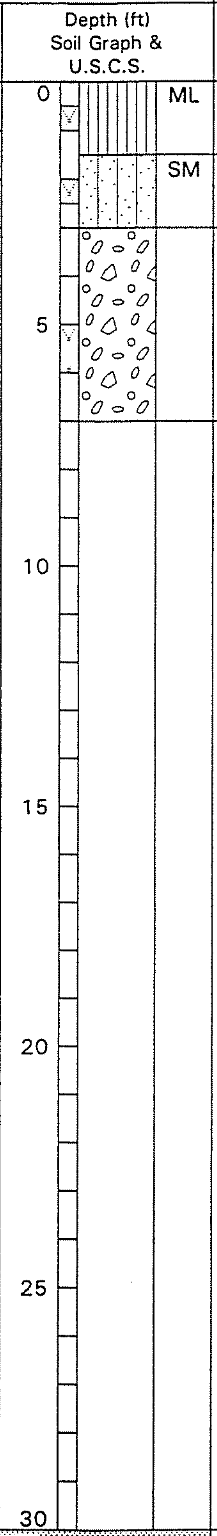
TEST PIT NUMBER

PT-2

Sampling Method:
Bulk Samples

Sheet 1 of 1

Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)
1	-	8		
2	-	11		
3	-	-		



SANDY SILT (ML), dark brown, damp, fine grained sand, trace subrounded to subangular gravel up to 1.5", trace yellow slightly cemented sandstone, roots

SILTY SAND (SM), dark brown, moist, fine grained, trace subrounded to subangular gravel up to 1.5", trace yellow slightly cemented sandstone, roots

Gravel increasing in size and content

WELL-GRADED COBBLES WITH SAND AND GRAVEL, gray/brown, moist, subangular to subrounded up to 12", subangular to subrounded gravel up to 3", coarse grained sand, trace fine/medium grained sand and clay (57% cobble, 27% gravel, 14% sand, 2% clay)
Subrounded boulder at 7 feet with a maximum dimension of 16"

Bottom of test pit at 7 feet
No groundwater encountered

LOG OF TEST PIT

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LOS CAPITANCILLOS WETLANDS PROJECT
SAN JOSE, CALIFORNIA

Date: JULY 2000

Job No.: 99154.10

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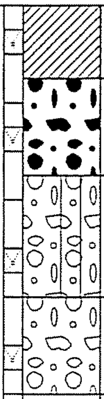
Plate:
A-7

Test Pit Location, Elevation & Date Performed: SEE ATTACHED SITE PLAN; Elev. approx. 242.0 ft.; performed on 5-25-00	Backhoe Test Pit	TEST PIT NUMBER **PT-3**
	Sampling Method: Bulk Samples	Sheet 1 of 1

Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)	Depth (ft)
1	-	7			0
2	-	2			
3	-	-			5
4	-	-			
					10
					15
					20
					25
					30



U.S.C.S.	Description	
CL	LEAN CLAY (CL), mottled dark brown/dark gray to black, damp, some fine grained sand	LL=32 PI=13
GP	POORLY-GRADED GRAVEL WITH SAND (GP), brown, damp, subangular to rounded gravel up to 2", fine to coarse grained sand, trace clay Some subangular to rounded cobbles up to 6"	+#4=75% -#200=3%
GW GM	WELL-GRADED GRAVEL WITH SILT AND SAND (GW-GM), gray/brown, moist to wet, subangular to rounded gravel up to 3", coarse grained sand, trace medium/fine grained, some cobbles up to 8" 2"-thick lens of black organic sandy lean clay	
GW	WELL-GRADED GRAVEL WITH SAND (GW), gray/brown, moist to wet, subangular to rounded up to 3", medium to coarse grained sand, trace fine grained sand and silt (66% gravel, 32% sand, 2% fines) Subrounded cobbles/boulders with a maximum dimension of 15" at 8 feet.	

Bottom of test pit at 8 feet
No groundwater encountered

LOG OF TEST PIT

PARIKH CONSULTANTS, INC.
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LOS CAPITANCILLOS WETLANDS PROJECT
SAN JOSE, CALIFORNIA

Date: JULY 2000
Job No.: 99154.10

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Plate: A-8

LB 99154 6-9-00

Test Pit Location, Elevation & Date Performed:
SEE ATTACHED SITE PLAN; Elev. approx. 244.5 ft.; performed on 5-25-00

Backhoe Test Pit

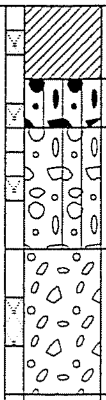
TEST PIT NUMBER
PT-4

Sampling Method:
Bulk Samples

Sheet 1 of 1

Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)
1	-	5		
2	-	6		
3	-	-		
4	-	-		

Depth (ft) Soil Graph & U.S.C.S.: 0, 5, 10, 15, 20, 25, 30



U.S.C.S.	Description	
CL	SANDY LEAN CLAY WITH GRAVEL (CL), brown/dark brown, damp, fine grained sand, trace medium/coarse grained, subangular to subrounded gravel up to 2", roots	
GM	SILTY GRAVEL WITH SAND (GM), brown/gray, moist, subrounded to subangular up to 1.5", fine grained sand, trace medium grained, some coarse grained	+#4=37% -#200=27%
GW GM	WELL-GRADED GRAVEL WITH SILT AND COBBLES (GW-GM), brown/gray, moist, subrounded to subangular up to 3", coarse to medium grained sand, trace fine grained, subangular to rounded cobble up to 8"	
	Cobbles increasing in size and content POORLY-GRADED COBBLES WITH GRAVEL AND SAND, brown/gray, moist, subangular to subrounded up to 12", subangular to rounded gravel up to 3", coarse grained sand, trace fine/medium grained (75% cobble, 13% gravel, 10% sand, 2% fines) Subrounded boulder with a maximum dimension of 15" at 8 feet	

Bottom of test pit at 8 feet
No groundwater encountered
Additional samples collected at 6" and 4' for the environmental study

LOG OF TEST PIT

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

LOS CAPITANCILLOS WETLANDS PROJECT
SAN JOSE, CALIFORNIA

Date: JULY 2000

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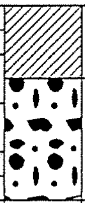
Plate:
A-9

LB 99 9-00

Test Pit Location, Elevation & Date Performed: SEE ATTACHED SITE PLAN; Elev. approx. 244.0 ft.; performed on 5-25-00	Backhoe Test Pit	**TEST PIT NUMBER** **PT-5**
	Sampling Method: Bulk Samples	Sheet 1 of 1



Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)	Depth (ft)	U.S.C.S.	Description
1	-	8			0	CL	SANDY LEAN CLAY (CL), brown/dark brown, damp, fine grained sand, trace subangular to subrounded gravel up to 2"
						GP	
2	-	-					POORLY-GRADED GRAVEL WITH SAND AND COBBLES (GP), gray/brown, moist, subangular to rounded up to 3", coarse to medium grained sand, subrounded to rounded cobbles up to 6" (14% cobble, 61% gravel, 24% sand, 1% fines)
					5		Bottom of test pit at 4 feet No groundwater encountered
					10		
					15		
					20		
					25		
					30		

LOG OF TEST PIT

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LOS CAPITANCILLOS WETLANDS PROJECT
SAN JOSE, CALIFORNIA

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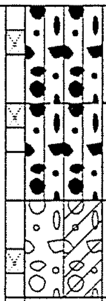
Plate: A-10

Test Pit Location, Elevation & Date Performed: SEE ATTACHED SITE PLAN; Elev. approx. 242.0 ft.; performed on 5-25-00	Backhoe Test Pit	TEST PIT NUMBER **PT-6**
	Sampling Method: Bulk Samples	Sheet 1 of 1



Sample Type & No.	Dry Density (pcf)	Water Content (%)	Blows Per Foot	Compress. Strength (tsf)	Depth (ft)	U.S.C.S.	Description	
					0	GM	SILTY GRAVEL WITH SAND (GM), brown, damp. subrounded to subangular up to 1.5", fine to coarse grained sand, roots (FILL) Trace cobbles up to 5"	+#4=53% -#200=18%
1	-	4						
2	-	10				GM	Layer of SILTY GRAVEL mixed with burried garbage (bottles, pieces of steel from drums, wires, buckets, a 7" O.D. chimney pipe, etc.), roots (FILL)	
						GW GC	WELL-GRADED GRAVEL WITH CLAY AND SAND (GW-GC), gray/brown, moist, subrounded to well rounded up to 3", coarse to medium grained sand, trace fine grained sand and clay, trace subangular to rounded cobbles up to 4", (8% cobbles, 70% gravel, 17% sand, 5% clay) Subrounded boulder with a maximum dimensoin of 15" at 8 feet	
3	-	-			5			
							Bottom of test pit at 6 feet No groundwater encountered	
					10			
					15			
					20			
					25			
					30			

LOG OF TEST PIT

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SAN JOSE, CALIFORNIA

Date: JULY 2000

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Plate:
A-11

00
LB 9915

APPENDIX B

APPENDIX B

LABORATORY TESTS

Classification Tests

The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System. The results are presented on "Log of Test Borings", Appendix A.

Moisture

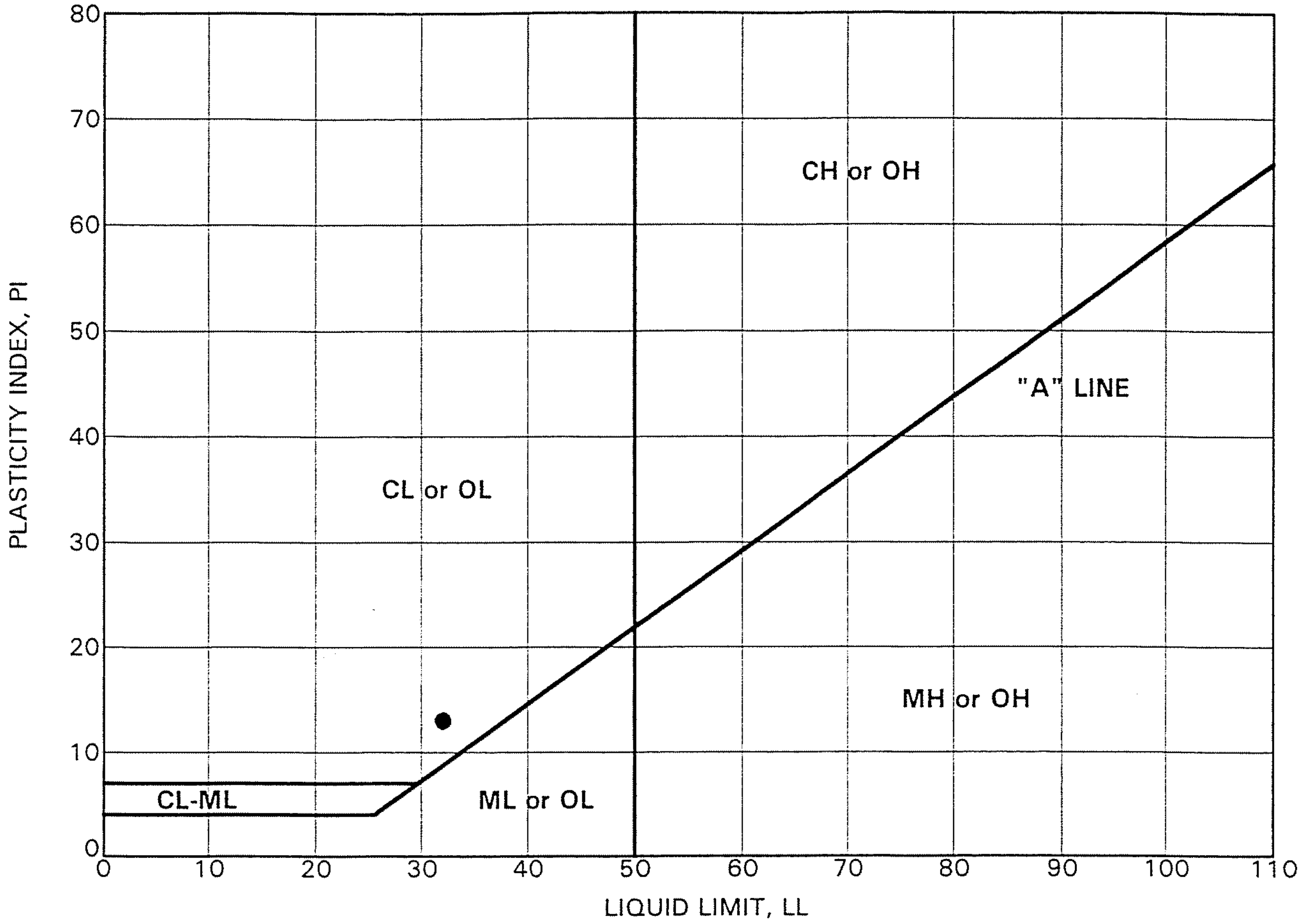
The natural moisture contents were determined for selected samples of the soils in general accordance with ASTM Test Method D 2216-92. This information was used to classify and correlate the soils. The results are presented at the appropriate depths on the "Log of Test Borings", Appendix A.

Atterberg Limits

The Atterberg Limits were determined for selected samples of the fine-grained materials. These results were used to classify the soils, as well as to obtain an indication of the expansion potential with variations in moisture content. The Atterberg Limits were determined in general accordance with ASTM Test Method D 4318-93. The results of these tests are presented on Plate B-2, "Plasticity Chart".

Grain Size Classification

Grain size classification tests (ASTM Test Method D 422-63) were performed on selected samples of granular soil to aid in the classification. The results are presented on Plates B-3A TO B-3F, "Grain Size Distribution Curves".



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
PT-3	1	0.5	●	7	32	19	13	LEAN CLAY (CL)

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PLATE NO: B-2

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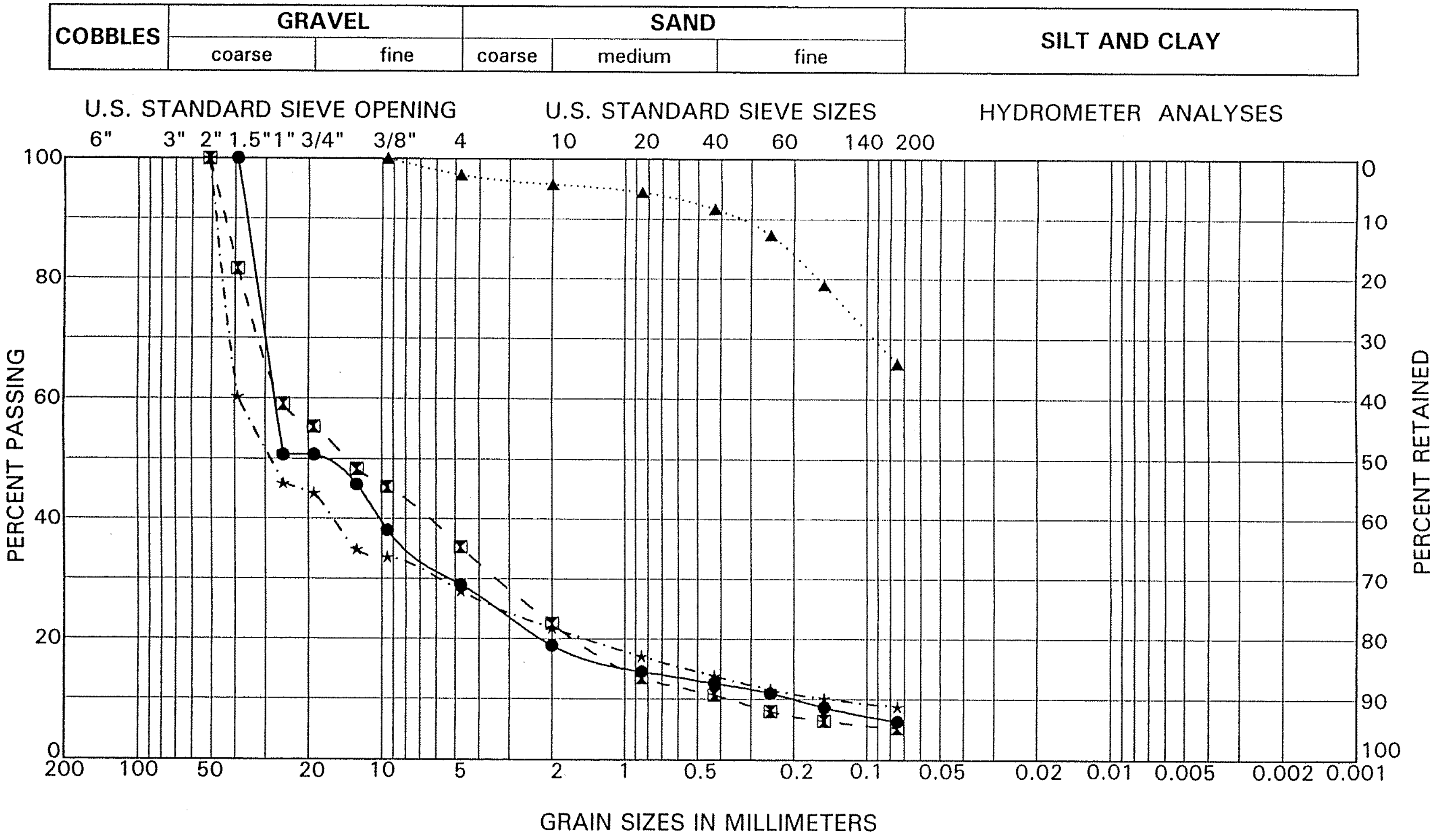
GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
B-1	2	2.5	●			POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM)
B-1	4	8.5	☒			WELL GRADED GRAVEL WITH CLAY AND SAND (GW-GC)
B-1	6	21.0	▲			SANDY LEAN CLAY (CL)
B-1	8	31.0	★			POORLY GRADED GRAVEL WITH CLAY AND SAND (GP-GC)

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JOB NO: 99154.10

PLATE NO: B-3A

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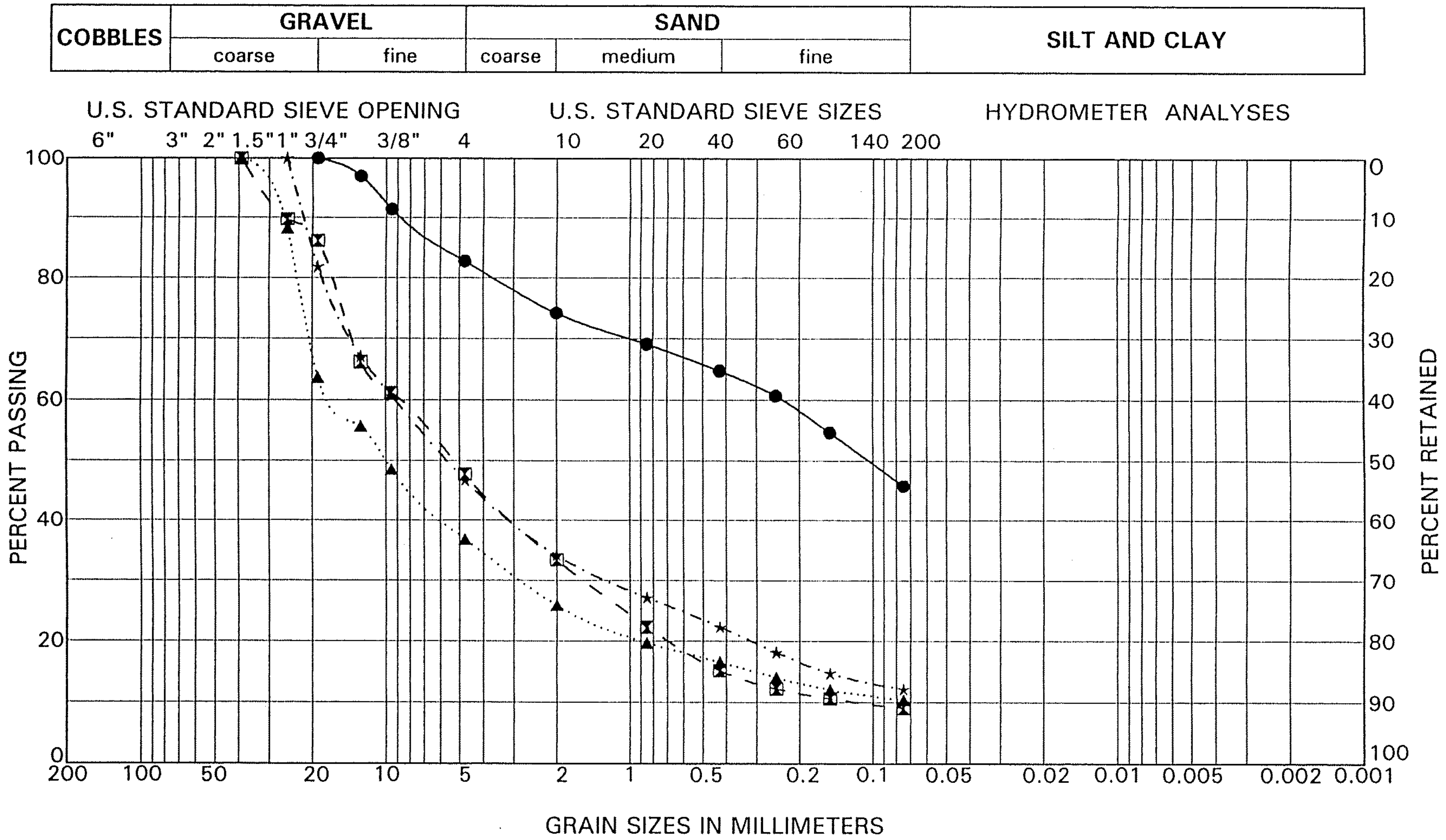
PLATE NO: B-3B

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
B-2	2	2.5	●			SANDY LEAN CLAY WITH GRAVEL (CL)
B-2	4	8.5	⊠			WELL GRADED GRAVEL WITH CLAY AND SAND (GW-GC)
B-2	6	19.5	▲			POORLY GRADED GRAVEL WITH CLAY AND SAND (GP-GC)
B-2	8	30.0	★			CLAYEY GRAVEL WITH SAND (GC)

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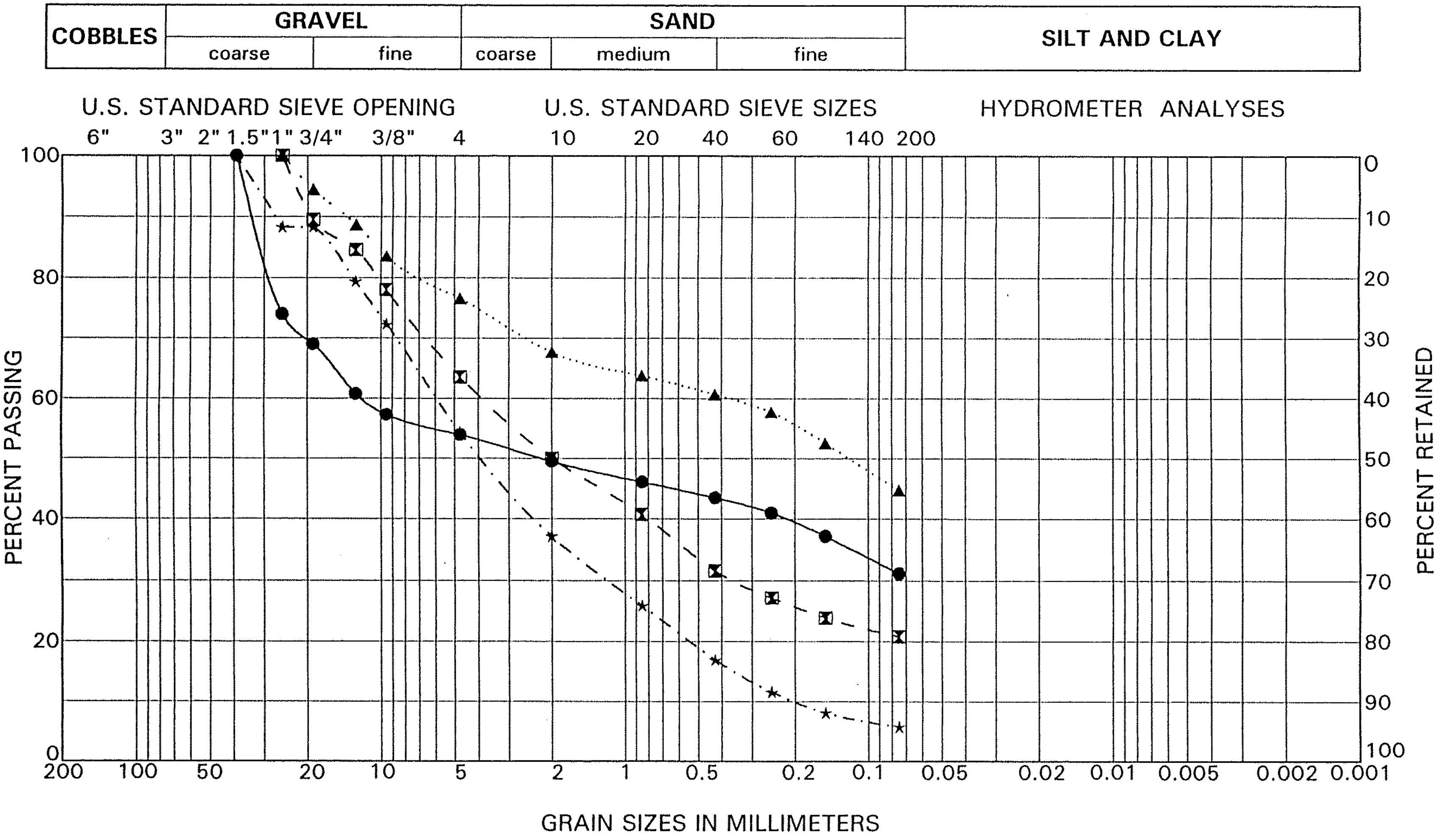
GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
B-3	2	2.5	●			CLAYEY GRAVEL WITH SAND (GC)
B-3	5	10.5	⊠			CLAYEY SAND WITH GRAVEL (SC)
B-4	1	1.0	▲			SANDY LEAN CLAY WITH GRAVEL (CL)
B-4	3	4.5	★			WELL GRADED SAND WITH CLAY AND GRAVEL (SW-SC)

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JOB NO: 99154.10

PLATE NO: B-3C

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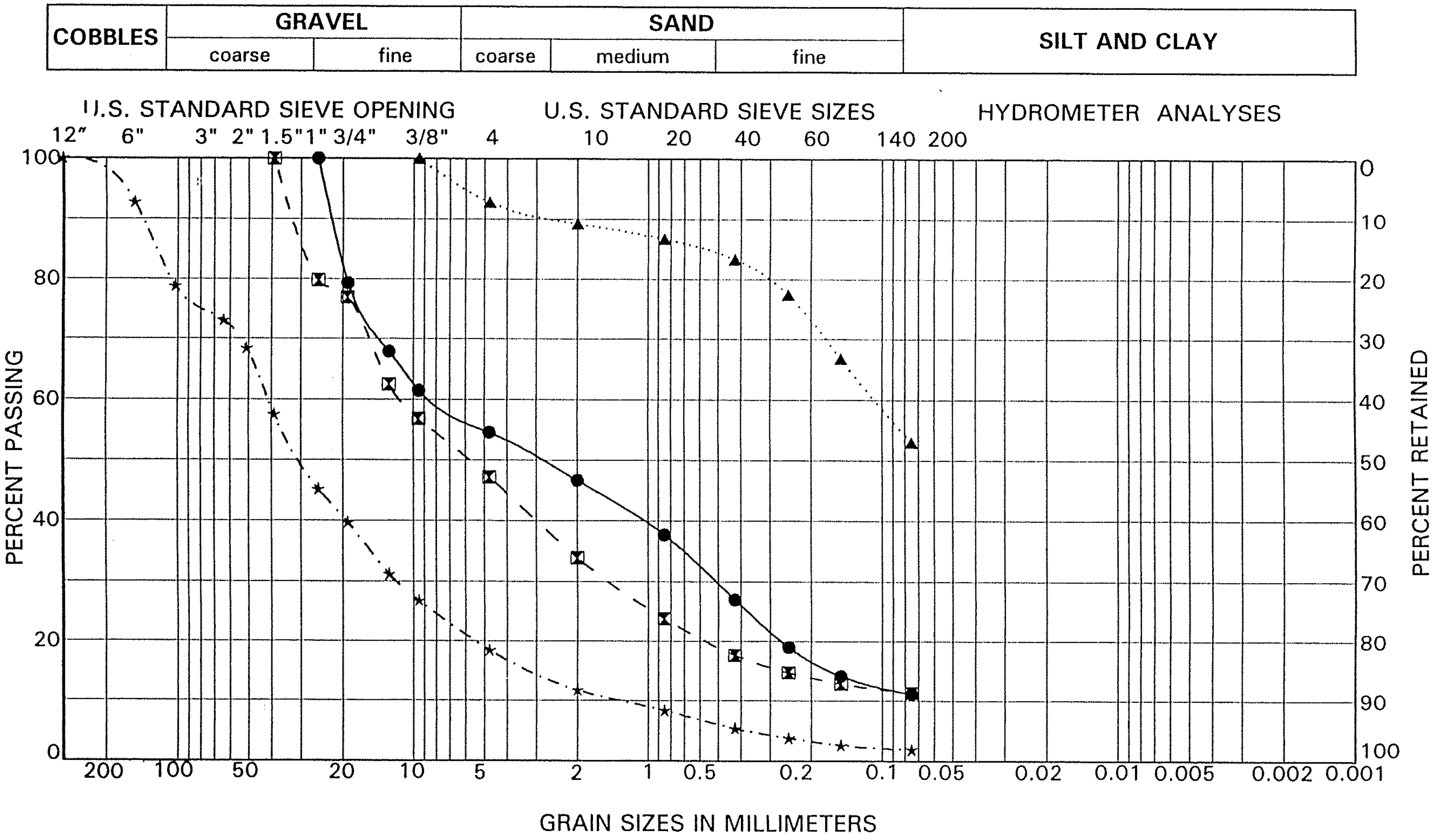
JOB NO: 99154.10

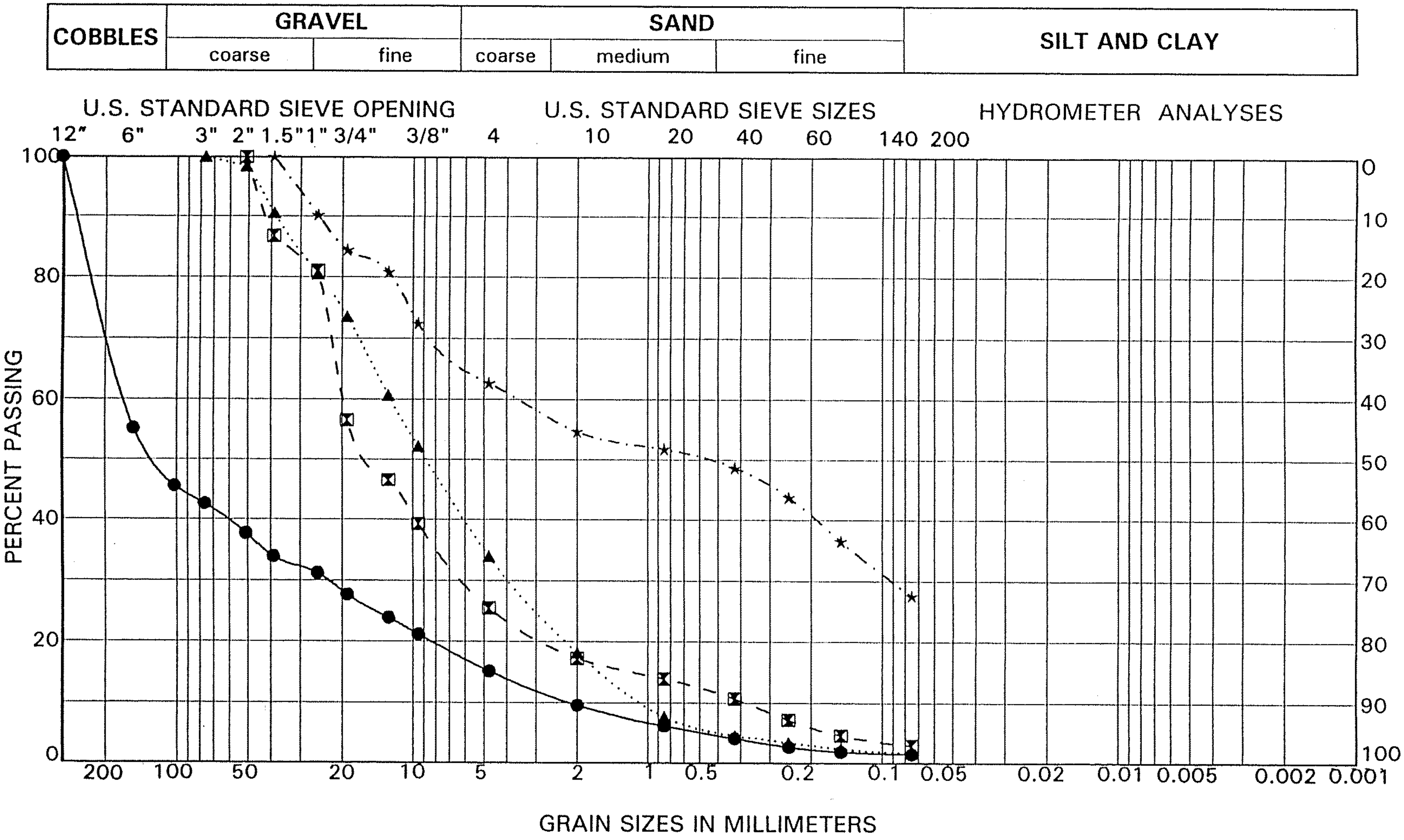
PLATE NO: B-3D

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
B-4	5	14.5	●			POORLY GRADED GRAVEL WITH CLAY AND SAND (GP-GC)
B-4	7	24.0	☒			WELL GRADED GRAVEL WITH CLAY AND SAND (GW-GC)
PT-1	2	2.0	▲			SANDY SILT (ML)
PT-1	4	7.0	★			WELL GRADED GRAVEL WITH SAND AND COBBLES (GW)

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
PT-2	3	5.0	●			WELL GRADED COBBLES WITH SAND AND GRAVEL
PT-3	2	2.5	☒			POORLY GRADED GRAVEL WITH SAND (GP)
PT-3	4	7.0	▲			WELL GRADED GRAVEL WITH SAND (GW)
PT-4	2	2.0	★			SILTY GRAVEL WITH SAND (GM)

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JOB NO: 99154.10

PLATE NO: B-3E

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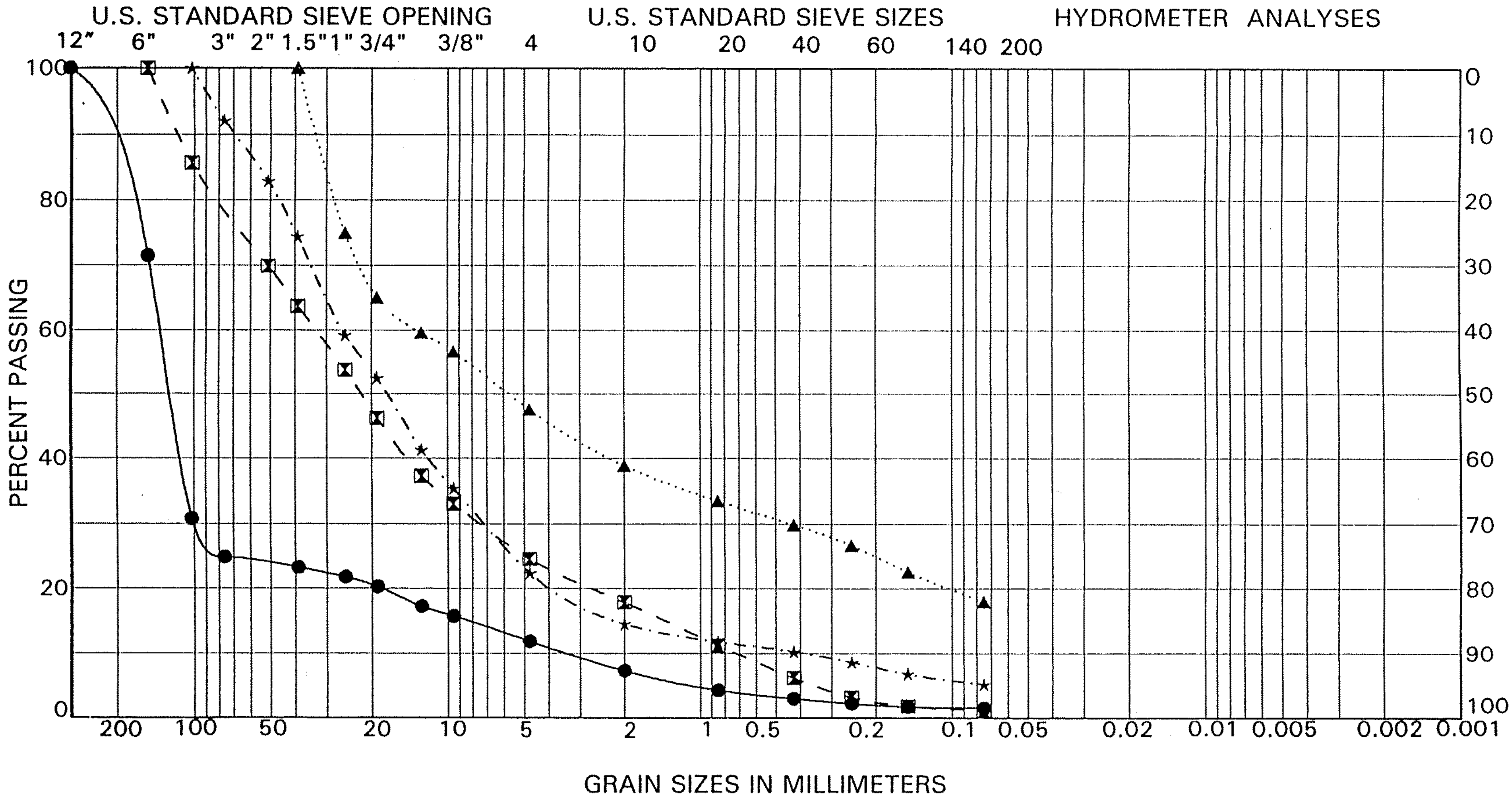
JOB NO: 99154.10

PLATE NO: B-3F

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	

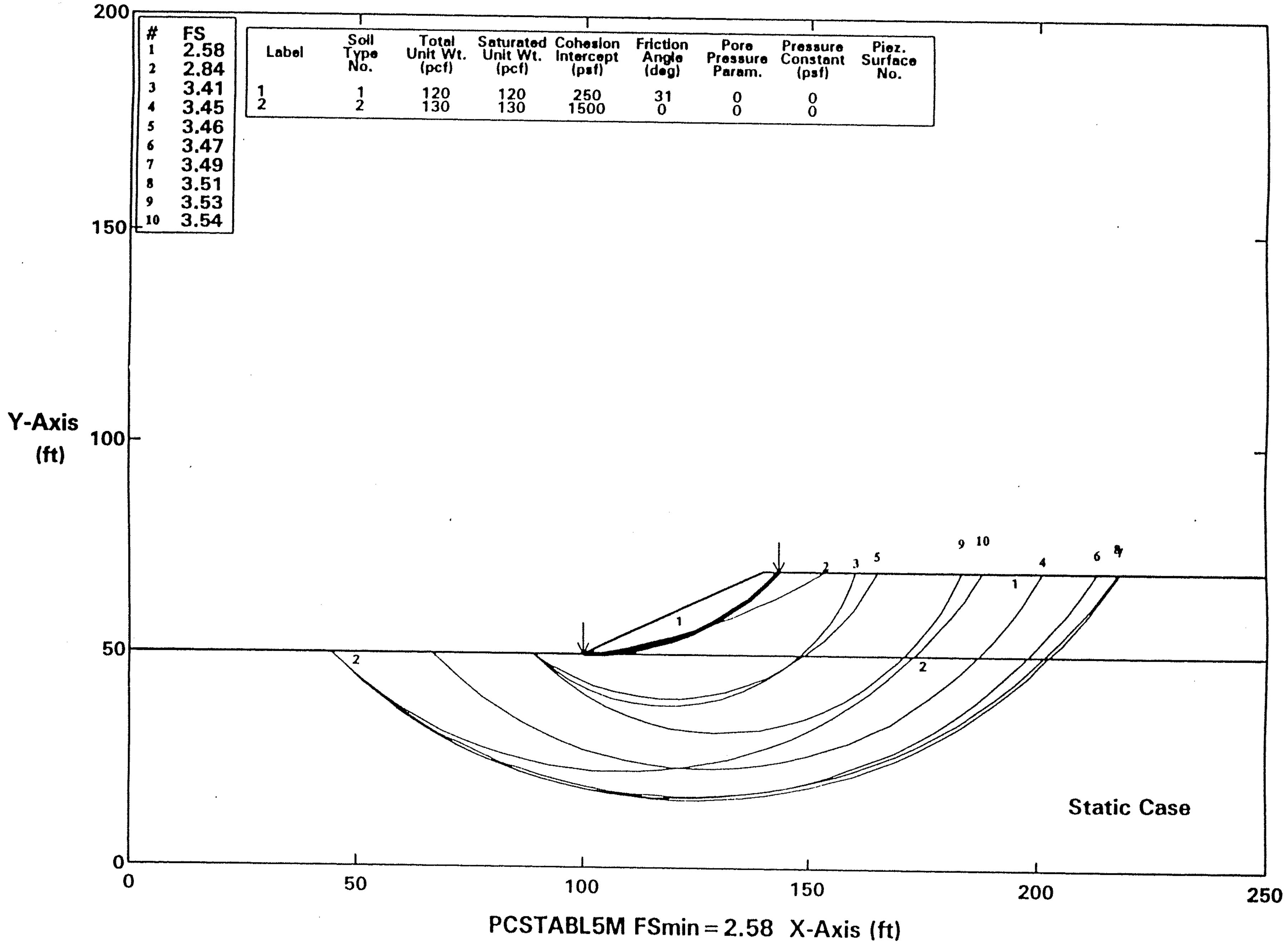


Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
PT-4	4	6.0	●			POORLY GRADED COBBLES WITH GRAVEL AND SAND
PT-5	2	3.0	☒			POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)
PT-6	1	0.5	▲			SILTY GRAVEL WITH SAND (GM)
PT-6	3	5.0	★			WELL GRADED GRAVEL WITH CLAY AND SAND (GW-GC)

APPENDIX C

Los Capitanc. .s Wetlands Project

Ten Most Critical. C:99150.PLT By: AK 06-03-00 12:05pm



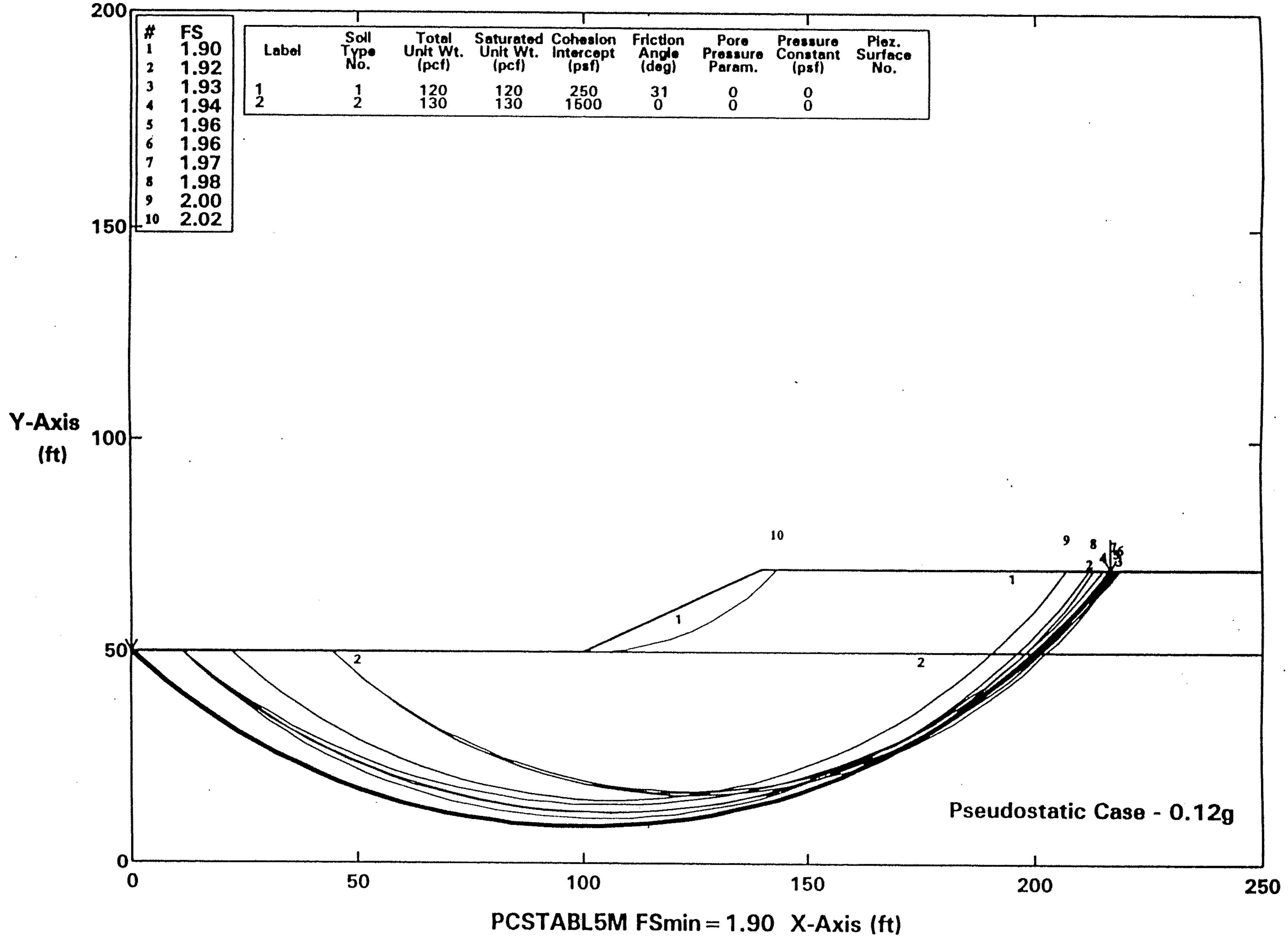
#	FS
1	2.58
2	2.84
3	3.41
4	3.45
5	3.46
6	3.47
7	3.49
8	3.51
9	3.53
10	3.54

Label	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	1	120	120	250	31	0	0	
2	2	130	130	1500	0	0	0	

PLATE C-1

Los Capitancillos Wetlands Project

Ten Most Critical. C:99152.PLT By: AK 06-03-00 12:06pm



#	FS
1	1.90
2	1.92
3	1.93
4	1.94
5	1.96
6	1.96
7	1.97
8	1.98
9	2.00
10	2.02

Label	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	1	120	120	250	31	0	0	
2	2	130	130	1500	0	0	0	

PI E C-2

APPENDIX D

H.T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

MEMORANDUM

PROJECT # 1700-01(4.0)

TO: Jeremy Lowe
Philip Williams & Associates
Fax # (415) 945-0606

FROM: Max Busnardo and John Bourgeois

DATE: August 3, 2001

CC: Betty Andrews and Mark Lindley- PWA
Dan Stephens, Pat Reynolds, John Bourgeois - H.T. Harvey & Associates

SUBJECT: **Los Capitancillos Freshwater Wetland Mitigation Project: Assessment of Eutrophication Potential for the Near-Perennial Hydroperiod Alternative**

Introduction

We have recently (7/19/01) received nutrient data for the Almaden Valley Pipeline water. This data came from the SCVWD from water samples collected from pipeline inflows at the Santa Teresa Treatment Plant. It was assumed that the water quality of pipeline inflows at the Santa Teresa Treatment Plant will be similar to pipeline water to be discharged at the Los Capitancillos Mitigation Site. The data included monthly samples of mercury, ammonia (NH^3), nitrate (NO^3), phosphate (PO^4), potassium (K) and total organic carbon (TOC) from June 1994 (for most nutrients) to present. We also received temperature, rainfall and evaporation rates on 7/26/01. The objective of our analysis was to provide a *rough, qualitative* assessment of the potential for significant eutrophication to develop in a near-perennial wetland/pond from pipeline nutrient inputs.

Our examination of the nutrient data focused primarily on the concentrations and loading rates of phosphorus. However, we did not have any data for total phosphorus (TP), which would have been helpful in our analysis. The existing data was compared to data available in the literature that relates nutrient concentrations and loading rates to eutrophication in lake, pond, and/or wetland ecosystems. We also compared the pipeline nutrient data to nutrient concentrations associated with urban/residential storm water run-off and a wetland storm water treatment system in Napa. The effect of other hydrologic factors such as inflow rates, turnover rates, and drawdown timing were qualitatively examined.

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Background

Eutrophication is the process whereby aquatic ecosystem primary production (especially of algae) increases significantly to a point in which the water column becomes hypoxic (low dissolved oxygen concentrations) due to bacterial decomposition of decaying macroalgae and phytoplankton. We assessed the potential for development of severe eutrophic conditions because:

1. dissolved oxygen concentrations below 3-4 mg/L are detrimental to aerobic aquatic organisms, and;
2. low dissolved oxygen concentrations lead to increases in anaerobic bacterial respiration and *potentially* to foul odors associated with the metabolic by-products of anaerobic bacterial respiration.

Macroalgae, phytoplankton and submersed aquatic vegetation are a desirable, integral component of wetland, pond and lake ecosystems. They are the primary producers at the base of the aquatic food web and will rapidly colonize the Los Capitancillos wetland mitigation site. Numerous factors affect the rate of macroalgal and phytoplankton productivity in freshwater systems, including nutrient and light availability, water residence time, water depth and mixing conditions, as well as temperature. The interdependency of these factors creates a complex setting for determining, and subsequently managing for, the timing and severity of algal blooms. When light conditions are sufficient, phosphorus and nitrogen are typically the nutrients that regulate macroalgal and phytoplankton productivity. In freshwater ecosystems, phosphorus is often the primary factor that limits macroalgal and phytoplankton productivity. Therefore, our nutrient data assessment focused on the phosphorus concentration data.

Results

The data we received is summarized in Table 1 and the attached figures. The nutrient concentrations exhibit some seasonality, with spikes in concentrations typically occurring from December to April. However, no strong seasonal correlations are present.

Table 1. Mean Nutrient Concentrations from the Almaden Valley Pipeline, 6/94 – 7/01.

	Mercury	Ammonia	Nitrate	Phosphate	Potassium	Total Organic Carbon
Mean Value	<1 ug/L	<0.05 mg/L	2.55 mg/L	0.22 mg/L	2.59 mg/L	3.03 mg/L
Standard Error	-	-	0.09	0.01	0.06	0.06

Site Comparison. Perhaps the most appropriate qualitative analysis, is a comparison between the proposed Los Capitancillos project and a similar wetland creation project in the Bay Area. Two wetland treatment systems were designed and constructed at the South Napa Marketplace commercial development project site to remove contaminants from stormwater runoff (H.T. Harvey & Associates, 1999). The two passive, gravity-fed, water treatment systems are referred to as the North Pond and South Pond. Each pond consists of a smaller forebay detention basin designed to trap sediments and a larger, rectangular afterbay detention basin for the removal of dissolved contaminants. The North Pond functioned as a seasonal wetland, while the South Pond was designed to be a near perennial wetland pond complex with approximately 20% tall emergent vegetation and 80% open water (3-3.5 feet deep). Phosphate levels entering and exiting the pond systems ranged in value from <1 mg/L to 3 mg/L; levels comparable to those found in the Almaden Valley Pipeline. Three years after installation, although macroalgae, phytoplankton and submersed aquatic vegetation were present in both Pond areas, the systems were functioning as designed with no indication of undesirable odors or eutrophication problems.

In addition, the Almaden Valley Pipeline nutrient concentrations for phosphate are substantially lower than those found in some urban streams (7-10 mg/L in Lyndhurst, Ohio) or from typical highway stormwater (0.9 mg/L) or residential/commercial (0.5 mg/L) runoff in Santa Clara Valley (Sutheimer, S.H. 1996 and Santa Clara Valley Nonpoint Source Pollution Control Program). When viewed in this context, the phosphate values from the pipeline seem more desirable than water entering the site from the surrounding watershed.

N:P Ratio. One impediment to assessing eutrophication potential for the Los Capitancillos wetland mitigation pond, is that critical nutrient data such as total Kjedahl nitrogen (TKN) and total phosphorus (TP) were not available. By utilizing the existing data, we have had to make several critical assumptions in an attempt to elucidate eutrophication potential at the site. Kerekes (1983) indicates that ortho-phosphate concentrations can approach 45-50% of the total phosphate concentrations in samples that have concentrations similar to those found in the pipeline samples. We can therefore make a rough estimate of 0.45 mg/L for the average concentration of total phosphorus (TP) for the Almaden Valley Pipeline water. Using this rough estimate of total phosphorus and adding nitrate and ammonia values together, we can get an approximation of the N:P ratio. In this case, the N:P ratio would be 5.7 This ratio would indicate a potentially eutrophic situation; however, it is based on a rough prediction of TP and TKN using the available data for the inorganic forms of P and N.

Loading Rates. Another method of assessing eutrophication potential in the pond system is by taking the phosphate data and calculating loading rates. The Vollenweider model was used as an indicator of potential phosphorus loading into the Los Capitancillos wetland system (Vollenweider, 1976):

$$L\ (\mathrm{mg/m^2\ yr}) = P\ (z/t + 10)$$

L = Critical loading of phosphorus
P = Phosphorus concentration ($\mathrm{mg/m^3}$)
z = Mean pond depth (m)
t = Water residence time

This model was intended for use in lake systems using TP data; however, we utilized the existing phosphate data as a rough indicator of phosphorus loading into the Los Capitancillos wetland. In this example, the mean phosphate concentration of 0.22 mg/L (220 $\mathrm{mg/m^3}$) value of the proposed pipeline inflow was used for P. Mean depth (z) of the pond is designed to be approximately 3.3

feet (1.01 m) and water residence time (t) ranges from 7.6 to 11.5 days (Mark Lindley of PWA, pers. comm.). The longer water residence time was used (11.5 days, or 0.032 years). These values yield a loading rate of approximately 9.1 g PO^4 / m^2 yr. According to the research on eutrophication in lakes, this is a high loading rate, indicating a potentially hypertrophic situation (Vollenweider 1968). However, lake systems can differ substantially from the near-perennial wetland/pond design since lakes generally would have a longer residence time and tend to develop thermoclines. For example, foul odors and eutrophication did not develop in a mesocosm study of a perennially-ponded, tall emergent wetland system receiving very high TP loading rates of 54 g P / m^2 yr to 88 g P / m^2 yr (Busnardo, et.al. 1992).

Site Design Features. The calculated loading rate for phosphate is elevated due to the high inflow rate assumed for the pipeline, combined with a low overall volume of water in the pond. This high inflow rate is based on designing for a relatively permeable wetland soil cover with infiltration rates comparable to a poorly functioning percolation pond (Mark Lindley of PWA, pers. comm.). The loading of nutrients into the pond will be offset by high percolation rates and low residence time of the water in the wetland pond system. The constructed wetland pond will actually function more like a lotic (flowing water) system, which can tolerate higher nutrient levels than lentic (standing water) systems with long residence times. The drawdown period in the late summer will also help to offset the eutrophication process by preventing algae growth during the late summer.

There is a possibility that phosphorus will, over time, accumulate in the benthos as it adsorbs onto soil particles. Potential future release of phosphate into the water column via benthic nutrient regeneration cannot be addressed at this level of analysis. However, it is likely that once the sediment phosphate adsorption sites are equilibrated with the phosphate in the water column, the additional phosphate added to the system will continue to percolate down into the groundwater. Other design features that reduce eutrophication potential include the constant aeration of the water as it enters the pond system. This will ensure that the water remains well oxygenated, helping to prevent any potential hypoxic or anoxic conditions from forming.

Conclusion

It is our biological opinion that, due to the rate of nutrient input into the system, the potential for eutrophication is present. However, experience on comparable sites with similar nutrient levels indicates that, although algae formation will occur, the system should function as a healthy wetland pond and nuisances such as foul odors should be negligible. The drydown period will help alleviate potential eutrophication problems. We recommend that the dry down period commence in mid-July such that the pond bottom will be entirely drained by mid-August-early September. Then the pond bottom should be allowed to dry out for 2-4 weeks prior to refilling.

We also recommend that the monitoring of dissolved oxygen and chlorophyll-a be incorporated into the monitoring plan. Exceedence of threshold values for dissolved oxygen and potentially for chlorophyll-a would then trigger the use of algae control methods. These methods, including chemical and biological controls in place of copper sulfate products, should be administered by the Santa Clara Valley Water District under the same protocols that govern the percolation ponds.

References

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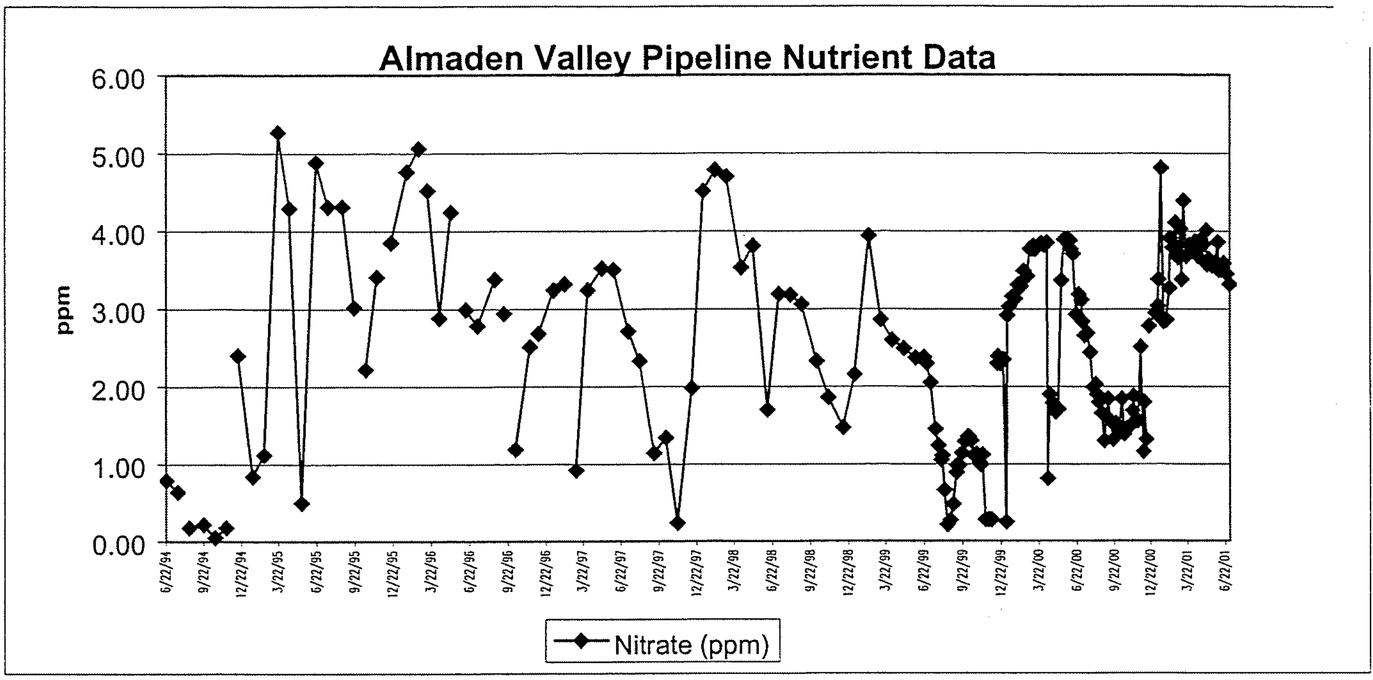
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5.00
4.00
3.00
2.00
1.00
0.00
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12/22/94
3/22/95
6/22/95
9/22/95
12/22/95
3/22/96
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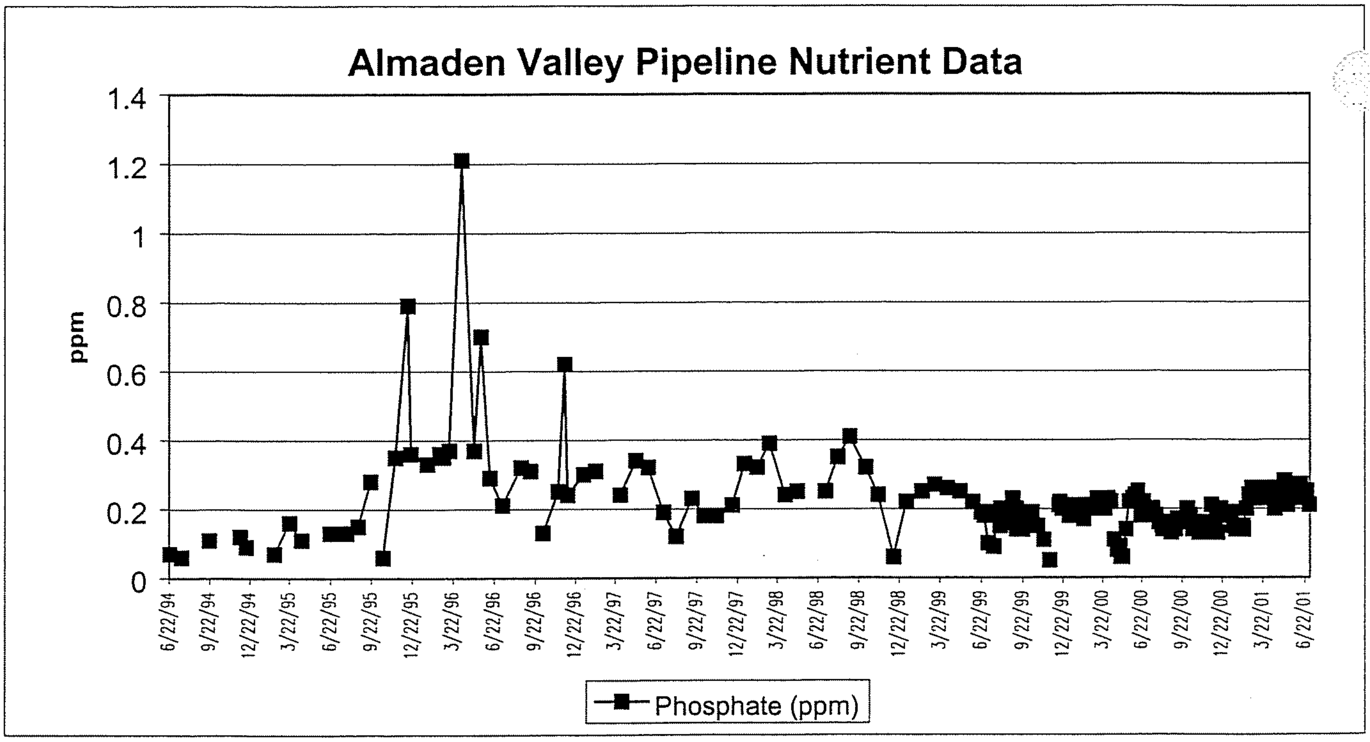
6/22/01
Nitrate (ppm)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0.2
0
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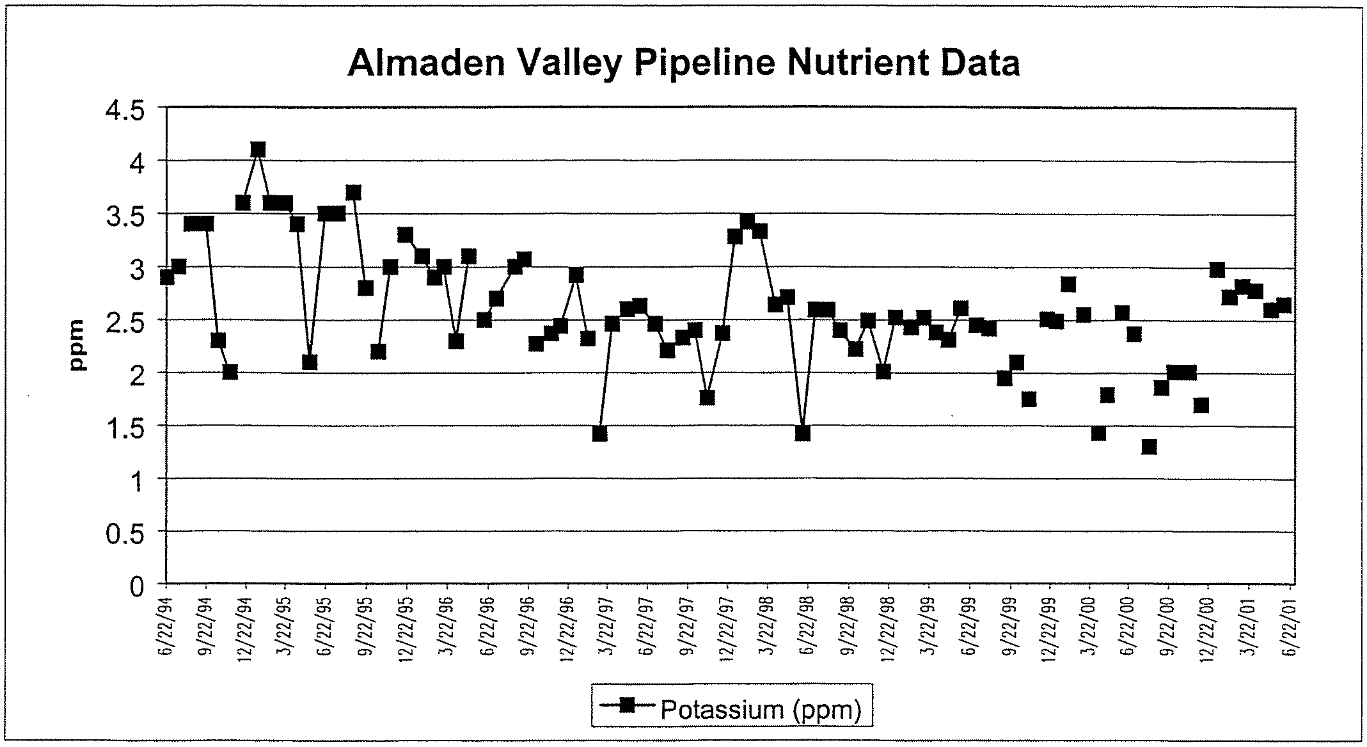
6/22/01
Phosphate (ppm)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3.5
3
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2
1.5
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0.5
0
6/22/94
9/22/94
12/22/94
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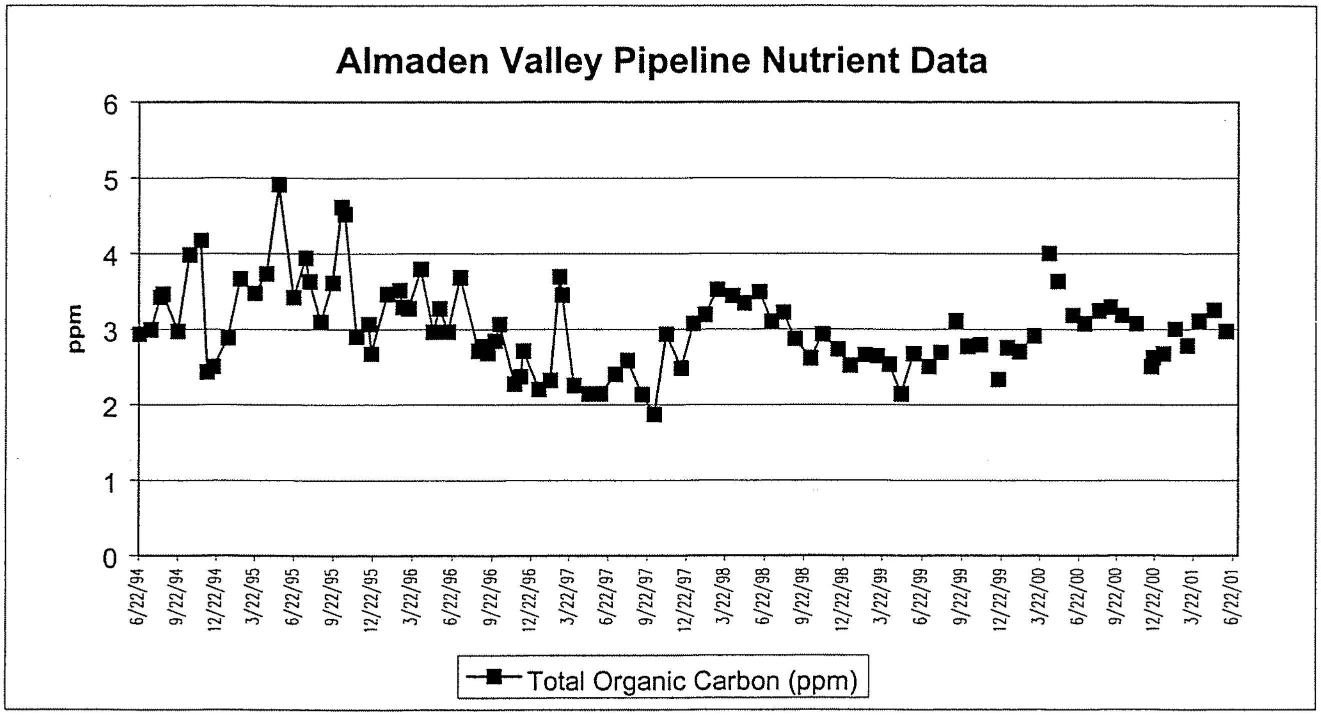
3/22/01
6/22/01
Potassium (ppm)


Almaden Valley Pipeline Nutrient Data
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4
3
2
1
0
6/22/94
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6/22/99
9/22/99
12/22/99
3/22/00
6/22/00
9/22/00
12/22/00
3/22/01
6/22/01
Total Organic Carbon (ppm)

Appendix D

Soils Report

H.T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

MEMORANDUM

~~PROJECT# 1700-01~~

TO: Betty Andrews
Phillip Williams & Associates
FROM: Max Busnardo
DATE: December 11, 2000
SUBJECT: **Los Capitancillos Wetland Mitigation Project: Final (Revised) Soils Report**

Attached please find the Final (Revised) Soils Report for the Los Capitancillos Wetland Mitigation project site. This revised report incorporates the comments from the Santa Clara Valley Water District. The answers to a few Gale Rankin questions were not necessarily appropriate for inclusion into the report itself and are provided below:

1. **What was limiting root depth of annuals to 2 inches?** Root distribution generally responds directly to availability of moisture and nutrients. Insofar as annuals such as those encountered on site routinely can root to 12-18 inches, our best guess is that limited availability of moisture caused roots to become concentrated in the top 2 inches of the soil profile. Additional considerations are that root penetration becomes increasingly more difficult in these alluvial soils as stones and gravels increased with depth.

2. **Can you postulate the source of moisture observed in Pit 3?** This pit was closest to the creek and appeared to be benefiting from moisture from the creek. There wasn't an evidence elsewhere on site that it was a wetting front associated with a rainfall event. Capillary action in soil horizons of this texture is expected to be very minimal to non-existent. Soil horizons C2 and C3 appeared to be of uniform moisture.

3. **Are there any cobbles or are they considered equivalent to stones?** Stones were described as varying in size from less than ½ inch in diameter to over 24 inches; this included cobbles.

4. **Doesn't fertility of soils matter less in inundated environments?** Soil fertility is as important to plant productivity in wetlands as it is in terrestrial systems. For example, nutrient addition field experiments have shown that wetland plant productivity is nitrogen or phosphorus limited in many instances. The low soil redox potential resulting from prolonged inundation and the associated biogeochemical changes generally leads to a reduction in available nutrient levels and/or a reduction in plant nutrient assimilation rates. Therefore, appropriate soil texture/structure and sufficient organic matter and nutrient levels must be present to ensure the high productivity typically associated with wetland emergent vegetation. For example, studies on a salt marsh creation site in San Diego County have demonstrated that coarse textured soils and low organic matter levels in the created marsh were associated with lower plant height and productivity compared to an adjacent natural marsh.

H.T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

December 11, 2000

Ms. Betty Andrews
Philip Williams & Associates
770 Tamalpais Drive, Suite 401
Corte Madera, CA 94925
PHONE: 415.945.0600
FAX: 415.945.0606

SUBJECT: Los Capitancillos: Freshwater Wetland Mitigation- Final (Revised) Soils Report

Dear Ms. Andrews:

We have completed our assessment of the soils at the Los Capitancillos Wetland Mitigation Site. This work is part of our contract regarding freshwater wetland mitigation design at the site. The following revised letter report specifically addresses several key soil characteristics to be considered during restoration design and incorporates comments from Gale Rankin of the Santa Clara Valley Water District.

The Los Capitancillos wetland mitigation site is located in southwestern San Jose situated between Guadalupe Creek and Coleman Road. The creek receives controlled releases of water from Guadalupe Reservoir situated approximately 4.5 miles upstream from the site.

According to the *Soils of Santa Clara County* (Soil Conservation Service 1968) the study area is underlain by two different soil series, Pleasanton and Yolo. A third soil type, Garretson, occurs directly adjacent to the property. Several key characteristics of these soils are summarized below in Table 1 (complete descriptions of these soils, taken from the county soils report, is provided in Appendix A). None of these soils appears on the hydric soil lists maintained by the SCS (1988).

Table 1. Key Characteristics of Soils Described by the *Soil Conservation Service (1968).

Soil series/phase	Texture/Parent Material/Substratum	Subsoil Permeability	Taxonomy subgroup/order	Fertility
Pleasanton gravelly loam, 0 to 2 percent slopes	Moderately-fine textured; gravelly sandy clay loam over old gravelly alluvium	Moderately slow	Mollic haploxeralf; alfisol	Moderate
Yolo silty clay loam, 0 to 2 percent slopes	Medium and moderately-fine textured; loamy sedimentary alluvium	Moderately slow	Typic xerorthent; entisol	High
Garretson gravelly loam, 0 to 5 percent slopes	Medium-textured, stratified gravelly loam	Moderately rapid	Typic xerorthent; entisol	Moderate

*Now called Natural Resource Conservation Service (NRCS).

METHODS

Technical Soil Description. Six soil pits (PT1 – PT6) were excavated by backhoe on 25 May 2000 by an independent contractor. Pits were dug to an approximate depth of between eight and nine feet. The pits measured approximately four feet by 20 feet. The location of each of these Test Pits, along with geotechnical boring locations, is shown on the aerial photograph of the site provided by the SCVWD (Appendix B). The soil test pit locations were determined by a Global Positioning System. Although the scope of work called for examination of four soil pits only, two additional soil test pits (PT-5 and PT-6) were excavated and qualitatively assessed to help determine if results from test pits PT1-PT4 were representative of the site. These soil pits were not examined with the same level of detail as described for PT1-PT4 below.

Several characteristics of soils were determined in the field, at soil pits PT1 – PT4, including horizonal development, texture, color and presence of redoxymorphic features, among other factors. This information was entered in the field onto Soil Test Pits Technical Description Forms. Soil textural classes were determined by the "feel method" in the field. Secondarily, a modified lab method was used on some of the samples to determine soil texture. This method involves suspending a small sample of soil in a dispersing reagent and flocculating agent in order to more quantitatively separate soil fractions into sands, silts and clays. Soil textures for the composite samples were also determined by Soil and Plant Laboratory, Inc.(Santa Clara, CA). Soil textures were reported according to the U.S. Department of Agriculture, SCS (1967) soil classification textural triangle.

Munsell Soil Notations (Munsell Soil Color Charts, Kollmorgen Instr. Corp. 1990) were recorded for the soil matrix for each soil sample. The last digit of the Munsell Soil Notation refers to the chroma of the sample. This notation consists of numbers beginning with 0 for neutral grays and increasing at equal intervals to a maximum of about 20. Chroma values of the soil matrix which are one (1) or less, or of two (2) or less when mottling is present, are typical of soils which have developed under anaerobic conditions. In addition, the Field Indicators of Hydric Soils in the United States, Version 4 (USDA, NRCS 1998) was used in the identification of hydric soil features.

Soil Laboratory Analysis. Two composite soil samples, each composed of four subsamples (one from each pit), were collected and analyzed for soil nutrients, texture, and organic matter content. This sampling effort was designed to evaluate the suitability of the site's soils to support establishment of the target emergent wetland vegetation. The two composite samples were taken from two different depths/soil horizons: the A horizon from four to 24 inches and the C horizon from four feet to six feet.

RESULTS

Technical Soil Description. For purposes of this study, soil horizons were defined primarily upon distinct differences in texture and color. The horizons for each of the pits were determined to be Ap, A1, C1, C2 and C3 depending upon several soil characteristics defined below.

Ap horizon-defined as the horizon found at the soil surface which has been disturbed from tillage or other mechanical means; the soil structure is characterized as granular resulting from repeated tillage. Soil matrix comprises fine sands, silts and clays, and higher concentrations of organic matter.

A1 horizon-primarily comprises organic matter, fine sands, silts and clays in varying concentrations; some small stones and a small percentage of medium and coarse sands were present; this horizon was distinct from Ap as it was more massive in structure and different from C1 as the percentage of stones and gravels was much less. Generally lower value/lower chroma.

C1 horizon-consists of high percentages of sedimentary alluvium (medium and coarse sands, stones and gravels) affected by pedogenic processes to limited extent, the smaller materials listed above as main components of the A horizon (fine sands, silts and clays) are present but in much smaller concentrations. Generally higher value/higher chroma than the overlying A horizons.

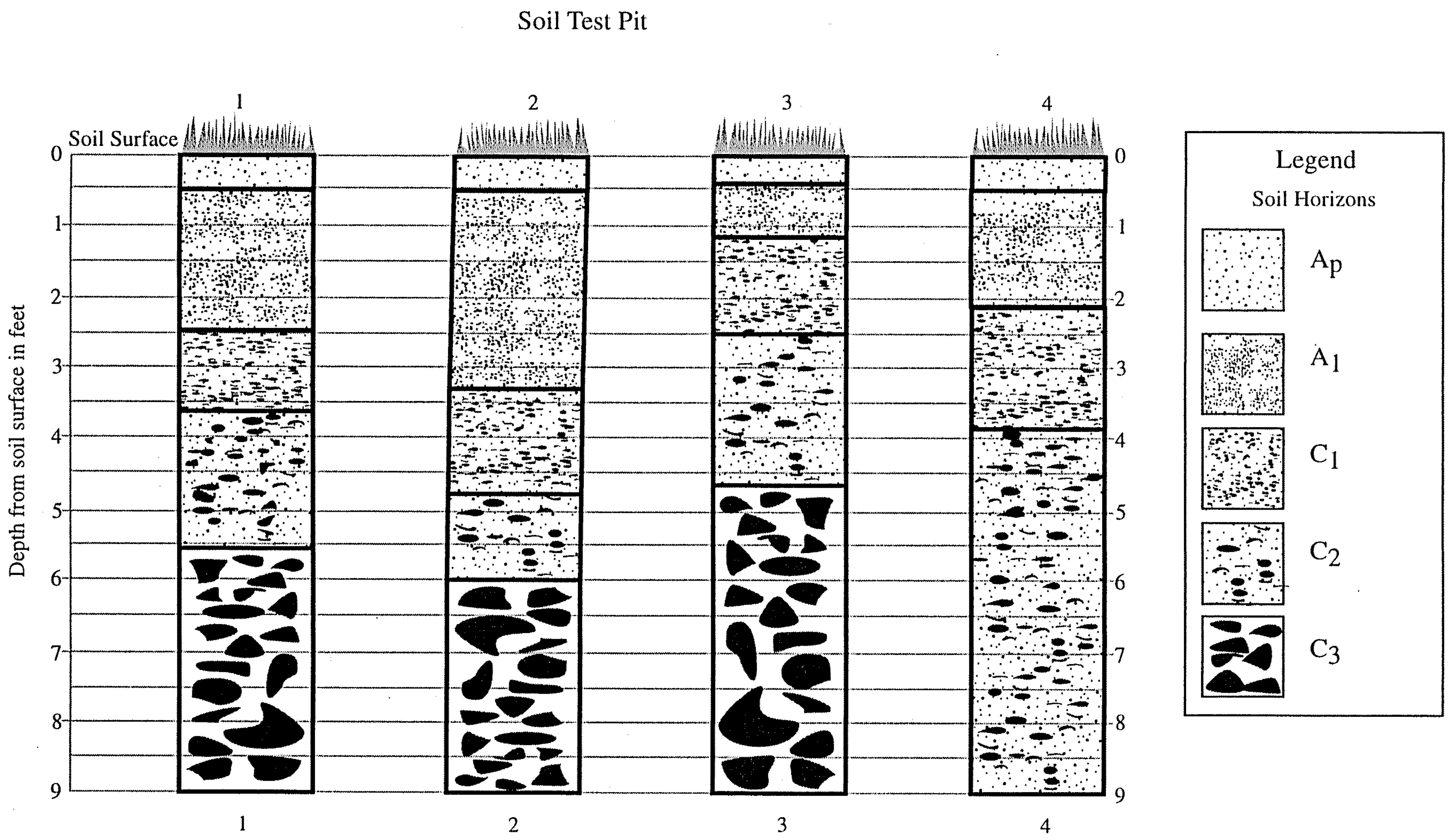
C2 horizon—comprises stratified alluvium (coarse sands, stones and gravels) devoid of fine sands, silts and clays.

C3 horizon-primarily consisting of large stones (two to 24 inches) and gravels.

Due to tillage in the relatively recent past a distinct, separate O-horizon, dominated by organic matter, undecomposed or partially decomposed litter, was not observed in any of the test pits. Two of the soil phases mapped as occurring on or near the study site are mapped as entisols. These are mineral soils with no or little evidence of development of pedogenic horizons and relatively little organic matter. The historical deposition of alluvial materials from Guadalupe Creek at regular intervals, prior to construction of the Guadalupe Dam, and relatively xeric nature of the site, has slowed soil horizonal development of the soils. As such, horizons were limited to variations of A-horizons (Ap and A1), and C-horizons (C1, C2 and C3). B horizons, which generally have illuvial concentrations of clay, iron, and humus, were not encountered in any soil test pit.

Appendix C presents photographs of each the four sample pits. These photos show a fairly distinct break in soil texture from the clay loam surface horizons to the stratified deposits of stones and gravels, located at varying depths from the surface. Data entered onto the Technical Description Forms are shown in Appendix D. From notes on soil texture a diagram (cross-section) was created showing a soil profile drawing comparison of the four profiles relative to depth of horizon and texture (Figure 1).

The field analysis of soil textures (via the feel method) generally yielded surface soil (A horizons) textures of silty clay loam to clay loams. The modified lab analysis test primarily yielded clay loam soil textures, although sandy clay loams and sandy clay textures were determined. Percent fine sands varied from 33 to 50%; silts from 10 to 27%, and; clays from 33 to 47%. Although silts were a common component of the



H.T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

Los Capitancillos:
Soils Report; Soil Test Pit Profiles

File No. **1700-01**	Date **7/10/00**	Figure **1**

samples, the threshold for including them as a descriptor of the textural class is greater than 40% per the USDA classification. Similarly, sands must be present at greater than approximately 45% to be a descriptor. The composite soil samples had textures of very gravelly loam (4 to 24 inch sample) and very gravelly, sandy loam (4-6 feet sample).

Soil Test Pit No. 1: This sample pit was located in the western portion of the site (PT-1, Appendix B) approximately 150 feet east of the top-of-bank of Guadalupe Creek. Silty clay loam textures were limited to the upper 22 inches of the soil test pit. Coarser textured soils were observed below this depth (Figure 1, Appendix C). Roots of annual grasses and forbs were restricted to the upper 2 inches of the profile; redoxymorphic features were not observed at any depth. Surface horizons were generally 7.5 YR 3/2 and 7.5 YR 2/2; 7.5 YR 4/4 was determined at 67 inches. Stones up to 12 inches were common in the C2 and C3 horizons. There was a lot of localized fill at the soil surface on this part of the study area. The fill material including broken imported soil, concrete, brick, asphalt and glass. Profile was relatively dry throughout.

Soil Test Pit No. 2: This sample was located in southeast corner of site (PT-2, Appendix B). Roots of annual grasses and forbs were restricted to the upper 2 inches of the profile. Silty clay loam textures were encountered (10 YR 3/2 and 3/3) to approximately 39 inches (Figure 1, Appendix C). Below this point stony loams and stratified sands, gravels and stones predominated (10 YR 3/4). Stones were generally between two and 24 inches in diameter. Soil moisture was not encountered in the profile.

Soil Test Pit No. 3: This sample pit was located in the northeast corner (PT-3, Appendix B) of the study area. The A horizons (Ap and A1) were relatively shallow (to 13 inches) and comprised more coarse-textured material than the previous sample pits (Figure 1, Appendix C). Soils colors did not vary significantly throughout the profile (7.5 YR 3/2, 3/3 and 3/4). Roots of annual grasses and forbs were restricted to the upper 2 inches of the profile. Tree fine roots were located down to approximately 36 inches and the profile was moist (below field capacity) below this depth. A large California sycamore (*Platanus racemosa*) root (approximate diameter four to six inches) was found at 54 inches below the soil surface; presumably from a sycamore tree located 100 feet to the north (Appendix B).

Soil Test Pit No. 4: This pit was located in the central portion of the site (PT-4, Appendix B). The A horizons extended down to 25 inches (10 YR 3/3) with stones comprising five to 10 percent of the soil volume. Coarse-textured materials dominated below this depth. The C2 horizon comprised stones (1-12 inches in diameter) and gravel in an approximately 50:50 mix. Since a distinct change in physical characteristics (e.g. textural class) was not observed within the C horizon, a C3 horizon was not identified down to nine feet depth.

Soil Test Pit No. 5: Soil test pit PT-5 was located between PT-4 and PT-3 in the eastern portion of the site. The horizonal development and distribution of textural classes with depth was comparable to that observed for pits 1, 2, 3, and 4. The A horizons were approximately 24 inches thick and consisted of a gravelly loam texture. Coarse-textured materials (coarse sands, gravels and stones) dominated below this depth.

Soil Test Pit No. 6: Soil test pit PT-6 was located at the eastern end of the site adjacent to a mature valley oak (*Quercus lobata*). In contrast to the pits 1 – 5, a mixture of trash debris and native soil backfill was encountered at depths of 1 to 4 feet. Trash debris was not encountered in the upper 1 foot or below approximately 4 feet. The A horizons in the upper foot of soil consisted of a gravelly loam texture. The identifiable trash debris encountered included old glass bottles, metal straps and metal buckets. Coarse-textured materials (coarse sands, gravels and stones) dominated below this depth. Two approximately 1-inch diameter oak roots were observed at a depth of 6 feet.

The features observed in each of the soil test pits relative to soil texture, color and other characteristics were closest to features described in the *Soils of Santa Clara County* (Soil Conservation Service 1968) under Yolo silty clay loam, 0 to 2 percent slopes, which presumably underlies most of the site. In contrast, the Pleasanton gravelly loam series described for a portion of the site, which included 15 to 20% gravels in the surface horizon and a well developed B horizons (clay loams and heavy clays) to 66 inches did not match features observed in the field; this soil is an alfisol with much better developed horizons than was encountered on site. Garretson soils are primarily loams with a few percent gravels in the surface horizons. The study area is situated directly adjacent to Guadalupe Creek; the subsoil comprises much larger alluvial materials closer to the soil surface than the typic descriptions provided in the county soil survey.

Soil Laboratory Analysis. Appendix E presents information form the soil lab analysis. The pH of each of the two composite samples was in the neutral range (pH 6.6 for the 4 in to 24 inch sample; pH 6.8 for the 4-6 foot depth sample). The samples taken from closer to the soil surface were higher in organic matter and plant macro-nutrients (nitrogen, phosphorous, potassium, calcium and magnesium). The concentrations for each of these nutrients is typical of poor to moderate soil fertility.

DISCUSSION

The purpose of the soil survey work was to assess site soil suitability for wetland habitat restoration. The primary features analyzed to determine this suitability were soil texture and fertility. Overall, the soil test pits were fairly similar in their stratification of soil horizons although they varied somewhat in the total depth of each of the A and C horizons. The trend was for deeper A horizons (Ap and A1) at the south/southwest end of the site, and shallower and coarser textured soils in the north/northeast corner of the study area.

As currently proposed, a portion of the proposed restoration site would comprise an open water habitat excavated to a depth which would preclude establishment of emergent wetland vegetation. This area would serve to provide habitat for wildlife species that utilize open water while providing a secondary benefit of percolating water into the shallow groundwater aquifer. Adjacent to the open water component would be an emergent wetland fringe with a minor riparian zone. Each of these design elements requires different site physical characteristics in order to function successfully. An open, loose-textured soil such as that encountered in all of the C horizons described in this report is ideal for percolation. For emergent wetland vegetation, a moderately dense soil texture (loam to clay loam to lighter clays) of moderate fertility is desired; the A horizons found on site represent a suitable growing medium. The more deeply rooted riparian trees and shrubs, generally adapted to lower soil fertility associated with alluvial deposits, would be expected to grow well on the native soils (i.e. A/C horizons).

The results from the four soil sample pits analyzed for this report were fairly consistent with information presented by Jones & Stokes Associates (JSA) in 1999. They excavated and characterized three soil sample pits within the Los Capitancillos proposed wetland mitigation area. These samples were described as deep groundwater phase map units (S1, S2 and S3). The JSA description included a 0-30 inch horizon: loam to clay loam (<15% coarse fragment) and a 30-120 inch layer: sandy loam to loamy sand (35-85% coarse fragments). They noted that groundwater occurred at depths greater than eight feet from the soil surface.

The results indicate that the topsoil texture and fertility characteristics would be suitable for the establishment of native wetland and riparian vegetation without the need for amendments. Therefore, we recommend that the design call for harvesting and stockpiling of the topsoil from 4-18 inches depth. The upper 4 inches of topsoil should be discarded to diminish the weed seed bank on the site. The mitigation site should then be over-excavated and the stockpiled topsoil spread across the wetland and riparian habitat established areas of the site. The preferred depth of this layer within the wetland/riparian planting zone should be at least 12 to 18 inches in depth.

If soils from the Los Capitancillos site are ultimately determined to be unsuitable for other reasons (e.g. mercury contamination), imported soil should target a soil texture between clay loam to clay with less than 70% total clays, the difference made up of a combination of sands and silts (to 30%).

The existing C horizons are currently unsuitable for wetland/riparian plantings by themselves as they are very coarse textured comprising almost entirely coarse sands, gravels and stones of varying sizes. This layer contains virtually no organic matter, and very little fine-textured soil components (clays and silts) which are the primary sources of soil-bound macro- and micro-nutrients bound in the soil. Planting in such a medium would restrict plants to obtaining nutrients primarily from the soil water, which is relatively low in such nutrients and only includes those that are water soluble. As noted above, a separate A horizon (comprising loams and clay loams) in combination with the C horizons are ideal for these plantings.

If you or your staff have any questions please feel free to contact me at (408) 448-9450 ext. 301 or our project manager, Max Busnardo, at extension 404.

Sincerely,

Max Busnardo for

Patrick J. Boursier, Ph.D.
Principal, Botany and Wetlands Division

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APPENDIX A

LOS CAPITANCILLOS: FRESHWATER WETLAND MITIGATION

SCS Soils Information

GARRETSON SERIES

The Garretson series consists of well drained, medium textured soils, underlain by sedimentary alluvium. These soils formed on nearly level to gently sloping first bottom positions along the larger drainageways. Vegetation is annual grasses and forbs, with a few scattered oak trees. Elevations range from 200 to 2,000 feet. Mean annual rainfall is 16 to 25 inches; mean annual air temperature is 58 to 60° F. The growing season is about 250 to 300 days. Esparto, Yolo and Zamora are the principal associated soils.

The surface soil ranges in thickness from 16 to 28 inches, and is a grayish brown neutral loam, gravelly loam or fine sandy loam. The subsoil is a brown, neutral, very fine sandy loam or loam, averaging 20 to 32 inches in thickness. The substratum is stratified, ranging from gravelly loam to sand and gravel.

Garretson soils are used for irrigated orchards, dryland grain hay and pasture.

Garretson loam, gravel substratum, 0 to 2 percent slopes (GaA). This soil occurs on first bottom positions, along the larger drainageways. The slopes usually average less than 2 percent.

Representative profile: In a walnut orchard, 6/10 of a mile south of Coyote and 50 feet north off farm road and 2/10 of a mile east off highway 101; Santa Clara County, California.

Ap	0 to 6 inches, grayish brown (10YR 5/2) loam, about 3 to 5 percent gravel, very dark grayish brown (10YR 3/2) when moist; massive; hard, friable, nonsticky and nonplastic; neutral (pH 7.0); clear smooth boundary. (4 to 10 inches thick).
A11	6 to 19 inches, grayish brown (10YR 5/2) loam, about 2 to 3 percent medium and fine gravel, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, nonsticky and nonplastic; many very fine, few medium tubular pores; neutral (pH 7.0); clear smooth boundary. (12 to 18 inches thick).
C1	19 to 40 inches, brown (10YR 5/3) very fine sandy loam, dark brown (10YR 4/3) moist; massive; hard, friable, nonsticky and nonplastic; neutral (pH 7.0); clear smooth boundary. (20 to 32 inches thick).
IIC2	40 to 60 inches, stratified sands and gravels.

Surface soil colors may be brown or grayish brown. Reaction in the surface and subsoil may be slightly acid, neutral or moderately alkaline. Structure is massive and the texture is typically a loam but may be clay loam. Subsoil colors are brown,pale brown or yellowish brown. Texture may be very fine sandy loam, or gravelly loam. Clay content of the subsoil will average between 18 and 35 percent. The substratum at depths of 36 to 60 inches is stratified sand and gravel. A few areas may be calcareous below 36 inches.

Included in mapping this soil are areas of Cortina very gravelly loam 15 percent, and a few areas of sand and gravel substratum within 20 inches of the surface.

This well drained soil holds about 5 to 7 inches of water for plant use. Subsoil permeability is moderate and runoff is very slow. Erosion hazard is not a problem. Fertility is moderate. Depth of rooting zone is deep but may be somewhat restricted by the sand and gravel substratum.

This soil is used for irrigated prunes, walnuts and dryland hay and pasture. Capability unit IIs4 (14) and IIIcl (15).

Garretson gravelly loam, 0 to 5 percent slopes (GbB). This soil occurs on nearly level to gentle slopes, averaging 2 to 4 percent. The texture is a gravelly loam or gravelly clay loam. Subsoil and substratum is usually stratified but the same texture as the surface; the sand or gravel strata is missing. Subsoil permeability is moderately rapid and the soil holds 7 to 8 inches of water plants can use. Favorable rooting depth is very deep; runoff is slow; erosion hazard is slight. Otherwise, this soil is similar to Garretson loam, gravel substratum, 0 to 2 percent slopes. Included in mapping are slopes that range up to 9 percent, and similar soils with dark grayish brown granular surface, formed on basic igneous rock alluvium.

This soil is used for irrigated prunes, apricots, walnuts and dryland hay or pasture. There is enough gravel present in the surface soil to interfere slightly with tillage operations. Capability unit IIs4 (14) and IIIcl (15).

Garretson fine sandy loam, 0 to 2 percent slopes (GpA). This soil is nearly level, with an average slope less than 2 percent. Texture is a fine sandy loam. Subsoil and substratum is stratified and the texture may be fine sandy loam, gravelly loam or sandy loam; the sand and gravel strata is missing. This soil holds 8 to 9 inches of water plants can use. Favorable rooting depth is very deep. Otherwise, it is similar to Garretson loam, gravel substratum, 0 to 2 percent slopes. Included in mapping are areas of gravelly loam texture and similar soils with mottled subsoils.

This soil is used for irrigated prunes, apricots, walnuts, dryland hay and pasture. Capability unit I-1 (14).

This land type is used for wildlife and recreation. A few areas are used by the city and county for dumping trash and other materials. Capability unit VIIIw4 (14).

PLEASANTON SERIES

The Pleasanton series consists of well drained soils, having moderately fine textured subsoils, underlain by old gravelly sedimentary alluvium. These soils formed on nearly level to moderately steep fans and terraces. Vegetation is chiefly annual grasses and forbs with scattered oak trees. Elevations range from 200 to 1,000 feet. Mean annual rainfall is 16 to 20 inches; mean annual air temperature is 58 to 60° F. The growing season is about 260 to 300 days. Hillgate and Arbuckle are the principal associated soils.

The surface soil averages 12 to 20 inches in thickness and is a grayish brown, slightly acid loam or gravelly loam. Subsoil is dark grayish brown and neutral gravelly clay loam, ranging from 24 to 30 inches in thickness. The substratum is neutral, yellowish brown, sandy clay loam over gravelly alluvial material extending to an undetermined depth.

Pleasanton soils are used for irrigated row crops, orchards, vineyards and dryland hay, pasture and range. They are also used for housing and commercial developments.

Pleasanton loam, 0 to 2 percent slopes (PoA). This soil occurs on nearly level old fans.

Representative profile: About 10 feet off north side of road on Dryden Avenue, 700 feet east of New Avenue; Santa Clara County, California.

Ap 0 to 5 inches, grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine interstitial and common very fine tubular pores; slightly acid (pH 6.5); abrupt smooth boundary. (0 to 6 inches thick).

A12 5 to 18 inches, grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine and medium roots; many very fine interstitial, common fine tubular and a few medium tubular pores; slightly acid (pH 6.5); clear wavy boundary. (12 to 14 inches).

B1t 18 to 23 inches, dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few medium roots; many very fine interstitial and tubular pores; common thin clay films lining pores and on ped faces;

neutral (pH 7.0); clear smooth boundary. (4 to 6 inches thick).

B2t 23 to 44 inches, brown (10YR 5/3) gravelly heavy clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; very hard, friable, sticky and plastic; few very fine roots; many very fine and fine, few medium tubular pores; many moderately thick clay films on ped faces and lining pores; neutral (pH 7.0); clear smooth boundary. (20 to 24 inches thick).

B3t 44 to 66 inches, yellowish brown (10YR 5/4) gravelly sandy clay loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, sticky and plastic; few medium roots; many very fine, fine interstitial and tubular, also a few medium tubular pores; common thin clay films in pores and on ped faces; neutral (pH 7.0).

The surface soil color is brown or grayish brown and occasionally dark grayish brown. Texture is typically loam but will range to a light clay loam with some medium and fine gravel, ranging from 3 to 5 percent by volume. Reaction is slightly acid to neutral and changes little with depth. Subsoil color is brown, dark grayish brown or yellowish brown. Texture is a gravelly clay loam or gravelly sandy clay loam. The substratum is lighter colored and more yellowish than the subsoil. Lime is occasionally present in the substratum.

Included in mapping this soil are 5 percent areas of San Ysidro loam; 5 percent Hillgate silt loam; and a few areas of soils similar to Pleasanton loam that have medium acid subsoils, 5 percent. The included soils are only moderately deep to a clay subsoil which may cause irrigation management problems.

This well drained soil is moderately fertile, and average water holding capacity is about 8 to 9 inches. Subsoil permeability is moderately slow. Surface runoff is very slow and erosion is not a problem. Favorable rooting depth is very deep but is somewhat restricted by the moderately fine textured subsoil.

This soil is used for irrigated row crops, apricots, prunes, walnuts, grapes, dryland grain hay and pasture. Large areas are also used for housing and commercial developments. Capability unit I-3 (14).

Pleasanton loam, 2 to 9 percent slopes (PoC). This soil occurs as small to moderately sized areas on slightly older alluvial fans. Average slope ranges from 3 to 5 percent. Runoff is slow to medium and erosion hazard is slight to moderate. Otherwise, this soil is similar to Pleasanton loam, 0 to 2 percent slopes. Included in mapping are areas of moderate sheet erosion.

This soil is used for irrigated prunes, apricots, grapes, walnuts, dryland hay and pasture. Large areas of this soil are also used for housing and commercial development. Capability unit IIe1 (14).

Pleasanton gravelly loam, 0 to 2 percent slopes (PpA). Except for being a gravelly loam on the surface, this soil is similar to Pleasanton loam, 0 to 2 percent slopes. The average percent of gravel ranges from 15 to 20 percent by volume. It holds about 5 to 7 inches of water plants can use. Included in mapping are areas of Cropley clay 10 percent; and 5 percent San Ysidro loam.

This soil is used for irrigated apricots, prunes, walnuts, grapes, dryland hay and pasture. It is also used for housing and commercial development. There is usually enough gravel on the surface to interfere slightly with tillage operations. Capability unit IIs4 (14).

Pleasanton gravelly loam, 2 to 9 percent slopes (PpC). This soil occurs as small to moderate sized areas at the upper part of the slightly older alluvial fans. Average slope is 3 to 5 percent. Texture is a gravelly loam on the surface; the gravel ranges from 15 to 25 percent by volume. Average water holding capacity is about 5 to 7 inches. Runoff is slow to medium and erosion hazard is slight to moderate. Otherwise, this soil is similar to Pleasanton loam, 0 to 2 percent slopes. Included in mapping, are small areas of Cropley clay 5 percent; 5 percent Hillgate silt loam, and 5 percent Yolo gravelly loam.

Except for areas in the small upland valleys, most of this soil is cultivated. It is used for irrigated prunes, apricots, grapes, dryland hay and pasture. There is generally enough gravel to interfere slightly with tillage operations. Capability unit IIIe4 (14).

Pleasanton gravelly loam, 9 to 15 percent slopes, eroded (PpD2). This soil occurs as small areas on strongly sloping terraces. Average slope is 12 percent. Texture is gravelly loam and the gravel ranges from 15 to 25 percent by volume. The average water holding capacity is about 5 to 7 inches. Runoff is medium, erosion hazard is moderate. Otherwise, this soil is similar to Pleasanton loam, 0 to 2 percent slopes. Included in mapping are small areas of 10 percent Hillgate silt loam; and areas of severe sheet erosion.

This soil is used for dryland hay, pasture and range. There is generally enough gravel to interfere slightly with tillage operations. Capability unit IVe1 (15); pasture and range site Loamy.

Pleasanton gravelly loam, 15 to 30 percent slopes, eroded (PpE2). This soil occurs as small areas on moderately steep terraces, facing toward deeply entrenched stream channels. The average slope is 20 percent. Texture is gravelly loam and the gravel ranges from 15 to 20 percent by volume. Average water holding capacity is about 5 to 7 inches. Runoff is rapid, and erosion hazard is high. Past sheet and gully erosion is moderate to severe. Otherwise, this soil is similar to Pleasanton loam, 0 to 2 percent slopes. Included in mapping are 10 percent areas of Positas loam; and 5 percent Saratoga loam.

This soil is used for dryland pasture and range. Capability unit VIe1 (15); pasture and range site Loamy.

POSITAS SERIES

The Positas series consists of well drained soils, having claypan like subsoils, underlain by old mixed alluvium. They formed on strongly sloping to moderately steep terraces. Vegetation is grasses, forbs and scattered oak trees. Elevations range from 200 to 2,000 feet. Mean annual rainfall is 16 to 20 inches; mean annual air temperature is 58 to 60° F. The growing season is 250 to 300 days. Pleasanton, San Ysidro and Azule are the principal associated soils.

The surface soil ranges from 10 to 25 inches in thickness and is a brown, medium acid loam. The subsoil is a reddish brown, medium acid clay ranging from 14 to 20 inches thick in the upper part, and yellowish brown, slightly acid clay loam, 8 to 15 inches thick in the lower part.

Positas soils are used for irrigated apricots, prunes, grapes, dryland hay and pasture. Some areas are used for housing and commercial developments.

Positas-Saratoga loams, 9 to 15 percent slopes (PrD). This complex consists of soils which are intermixed and it was not feasible to map them separately. They occur on strongly sloping terraces with an average slope of 12 percent.

A representative profile of Positas loam follows, and the profile for Saratoga loam is described under the respective series.

Representative Positas profile: 50 yards east of Almaden road, 1/2 mile south of McKean Road; Santa Clara County, California.

AP 0 to 7 inches, brown (10YR 5/3) loam, dark brown (7.5YR 3/2) moist; massive; hard, friable, nonsticky and nonplastic; few fine roots; many very fine tubular pores; medium acid (pH 6.0); clear smooth boundary. (5 to 8 inches thick).

A12 7 to 16 inches, brown (10YR 5/3) loam, dark brown (7.5YR 3/2) moist; massive; hard, friable, nonsticky and nonplastic; few fine roots; many very fine tubular pores; medium acid (pH 6.0); abrupt smooth boundary. (5 to 17 inches thick).

alkaline (pH 8.5); clear smooth boundary. (18 to 25 inches thick).

Cca 31 to 60 inches, light olive gray (5Y 6/2) clay, olive gray (5Y 5/2) moist, common fine distinct mottles brown (10YR 5/3) dry and dark brown (10YR 4/3) moist, and a few distinct mottles gray (5Y 6/1) dry and gray (5Y 5/1) moist; massive; very hard, firm, sticky and plastic; many very fine interstitial, tubular and a few medium tubular pores; many intersecting slickensides in the upper 10 inches; strongly effervescent, disseminated lime; strongly alkaline (pH 8.5).

Surface soil color may be dark gray or dark grayish brown. Reaction is moderately alkaline; lime is usually present in the lower surface. Few to many medium sized salt crystals are commonly found in the lower surface soil or subsoil. Texture is typically clay. When this soil is dry, deep cracks develop, averaging 1/2 to 1 1/2 inches in width. Color of the subsoil is olive gray, light olive gray or light yellowish brown. Distinct mottles start at an average depth of 12 inches and the colors are light brownish gray or brown and are gray in the lower subsoil.

Included in mapping this soil are areas of 15 percent Clear Lake clay; and a few areas of gentle slopes. About 20 percent of this acreage is covered by sandy clay loam textured overwash material 10 to 20 inches in thickness.

This poorly drained soil has a water table that fluctuates seasonally within 20 to 40 inches. Fertility is affected by moderate concentrations of neutral salts. It usually becomes ponded during winter months and erosion is not a problem. Subsoil permeability is slow and the average water holding capacity is about 4 to 7 inches. Rooting depth is usually restricted by the water table.

This soil is used for limited irrigated row crops and pasture. Salt tolerant grasses and forbs are the main pasture plants. Capability unit IVw6 (14).

Willows clay, slightly alkali (Wb). This soil has only slight concentrations of salts and salt tolerant plants are not usually affected. The water table is below 60 inches because natural drainage has improved with general lowering of the ground water level in the valley. Otherwise, this soil is similar to Willows clay. Included in mapping are areas of 10 percent Orestimba clay; 5 percent Sunnyvale silty clay; and areas with moderate to strong salt concentrations.

This soil is used for irrigated row crops, sugar beets, pears, and dryland grain hay and pasture. A few areas have been used for housing developments. Capability unit IIIw5 (14).

YOLO SERIES

The Yolo series consists of well drained, medium and moderately fine textured soils, underlain by sedimentary alluvium. They formed on nearly level to moderately sloping alluvial plains and fans. Vegetation is annual grasses and forbs, with a few scattered oak trees. Elevations range from 400 to 2,400 feet. Mean annual rainfall is 15 to 25 inches; mean annual air temperature is 58 to 60° F. The growing season is about 250 to 325 days. Zamora, Campbell and Esparto are the principal associated soils.

The surface soil ranges in thickness from 26 to 32 inches and is a grayish brown, neutral and mildly alkaline loam or silty clay loam. The subsoil and substratum are a brown, mildly alkaline silt loam or silty clay loam and extends to a depth of 60 inches or more.

Yolo soils are used for irrigated row crops, sugar beets, orchards, vineyards, dryland hay and pasture. Large areas are used for housing and commercial developments. These are the most productive soils in the Santa Clara Valley.

Yolo loam, 0 to 2 percent slopes (YaA). This soil occurs on nearly level alluvial plains and fans. Flooding is not usually a hazard except for a few low areas along drainageways, that may be flooded once in 20 years.

Representative profile: In a field 20 feet east of San Antonio Creek, 1/4 of a mile north of Harney School, in the San Antonio Valley in the Northwest corner of the N. W. 1/4 of the N. E. 1/4 of Sec. 1, T. 7 S., R. 4 E., Santa Clara County, California.

Ap	0 to 7 inches, grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; cloddy; hard, friable, nonsticky and nonplastic; abundant very fine roots; many very fine interstitial pores; neutral (pH 6.6); clear smooth boundary. (6 to 8 inches thick).
A12	7 to 29 inches, grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, nonsticky and nonplastic; plentiful very fine roots; many very fine interstitial and tubular, also a few fine and medium tubular pores; mildly alkaline (pH 7.5); clear smooth boundary. (20 to 24 inches thick).
C	29 to 60 inches, brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; massive; hard, friable, nonsticky and nonplastic; few very fine roots. many very fine interstitial, tubular and a few medium and fine tubular pores; mildly alkaline (pH 7.5).

Surface soil color may be grayish brown or brown. Reaction is mildly alkaline to slightly acid. Texture is typically a loam, but may be silt loam or light clay loam. The subsoil color is brown, yellowish brown or light yellowish brown. Reaction is neutral to mildly alkaline. Texture is stratified silt loam, silty clay loam, clay loam, loam, sandy loam, and in places may be gravelly. Average texture from 10 to 40 inches deep, is a silty loam or silty clay loam; lime may be present in a few places in the substratum, below 40 inches.

Included in mapping this soil are areas of similar soil that is pale brown on the surface; and areas of Zamora clay loam.

This well drained soil holds about 9 to 10 inches of water for plant use. Fertility is high. Runoff is very slow and erosion is not a problem. Subsoil permeability is moderate and the effective rooting depth is very deep.

This soil is used mainly for irrigated row crops, sugar beets, prunes, apricots, walnuts, pears, dryland hay and pasture. Crop production is high to very high. About 50 percent of this soil is used for housing and commercial developments. Capability unit I-1 (14, or IIIcl (15); pasture and range site, Loamy.

Yolo loam, 2 to 5 percent slopes (YaB). Except for occurring as small to moderate sized, gently sloping areas, this soil is similar to Yolo loam, 0 to 2 percent slopes. Texture is a loam or light clay loam. Erosion hazard is slight and runoff is slow. Included in mapping are bodies of gravelly soils; and, slopes ranging up to 9 percent.

This soil is used mainly for irrigated row crops, sugar beets, prunes, apricots, walnuts, dryland hay and pasture. Capability unit IIel (14), or IIIel (15); pasture and range site Loamy.

Yolo silty clay loam, 0 to 2 percent slopes (YeA). This soil occupies nearly level alluvial plains of the Santa Clara Valley. Surface soil texture is a silty clay loam or clay loam. Runoff is very slow and erosion is not a problem. Average water holding capacity is about 10 to 11 inches. Subsoil permeability is moderately slow. Otherwise, this soil is similar to Yolo loam, 0 to 2 percent slopes. Included in mapping are small bodies of gravelly soils; narrow areas of slope breaks; and Campbell silty clay loam.

This soil is used for irrigated row crops, sugar beets, prunes, apricots, walnuts, pears, grapes, and dryland hay and pasture. About 50 percent of this soil is used for housing and commercial developments. Capability unit I-1 (14).

Yolo silty clay loam, 2 to 9 percent slopes (YeC). This soil occupies gently to moderately sloping alluvial fans, with an average slope of 5 percent. Surface soil texture is a silty clay loam or clay loam. Runoff is slow to medium and erosion hazard is slight to moderate. Average water holding capacity is about 10 to 11 inches and permeability is moderately slow.

Otherwise, this soil is similar to Yolo loam, 0 to 2 percent slopes. Included in mapping are 10 percent areas of Garretson gravelly loam; and 5 percent Pleasanton gravelly loam.

This soil is used for irrigated row crops, sugar beets, prunes, apricots, walnuts, pears, grapes and dryland pasture. About 30 percent of this soil is used for housing and commercial developments. Capability unit IIe5 (14).

ZAMORA SERIES

The Zamora series consists of well drained soils having moderately fine textured subsoils, underlain by alluvium of mixed origin. They are formed on nearly level to moderately sloping alluvial fans. Vegetation is chiefly annual grasses and forbs, with scattered oak trees. Elevations range from 200 to 1,000 feet. Mean annual rainfall is 16 to 20 inches; mean annual air temperature is 58 to 60° F. and the growing season is about 250 to 300 days. Pleasanton and Yolo are the principal associated soils.

The surface soil averages 12 to 20 inches in thickness and is a dark grayish brown, neutral loam or clay loam. The subsoil is a dark brown or brown, neutral clay loam, ranging from 20 to 30 inches in thickness. The substratum is stratified, gravelly, sandy clay loam and fine sandy clay loam alluvium.

Zamora soils are used for irrigated row crops, orchards, vineyards, dryland hay and pasture. A few areas are used for housing and commercial developments.

Zamora clay loam, 0 to 2 percent slopes (ZbA). This soil occurs as nearly level fans in the Paradise Valley area and as smaller bodies throughout the survey area. Average slope is less than 2 percent.

Representative profile: In a prune orchard just about 30 feet southwest of the intersection of Bowden Avenue and Watsonville Road; Santa Clara County, California.

Ap 0 to 7 inches, dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; cloddy; hard, friable, sticky and plastic; few very fine roots; many very fine interstitial pores; neutral (pH 7.0); abrupt smooth boundary. (6 to 8 inches thick).

A12 7 to 15 inches, dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; massive; friable, sticky and plastic; few very fine and medium roots; neutral (pH 7.0); clear smooth boundary. (6 to 12 inches thick).

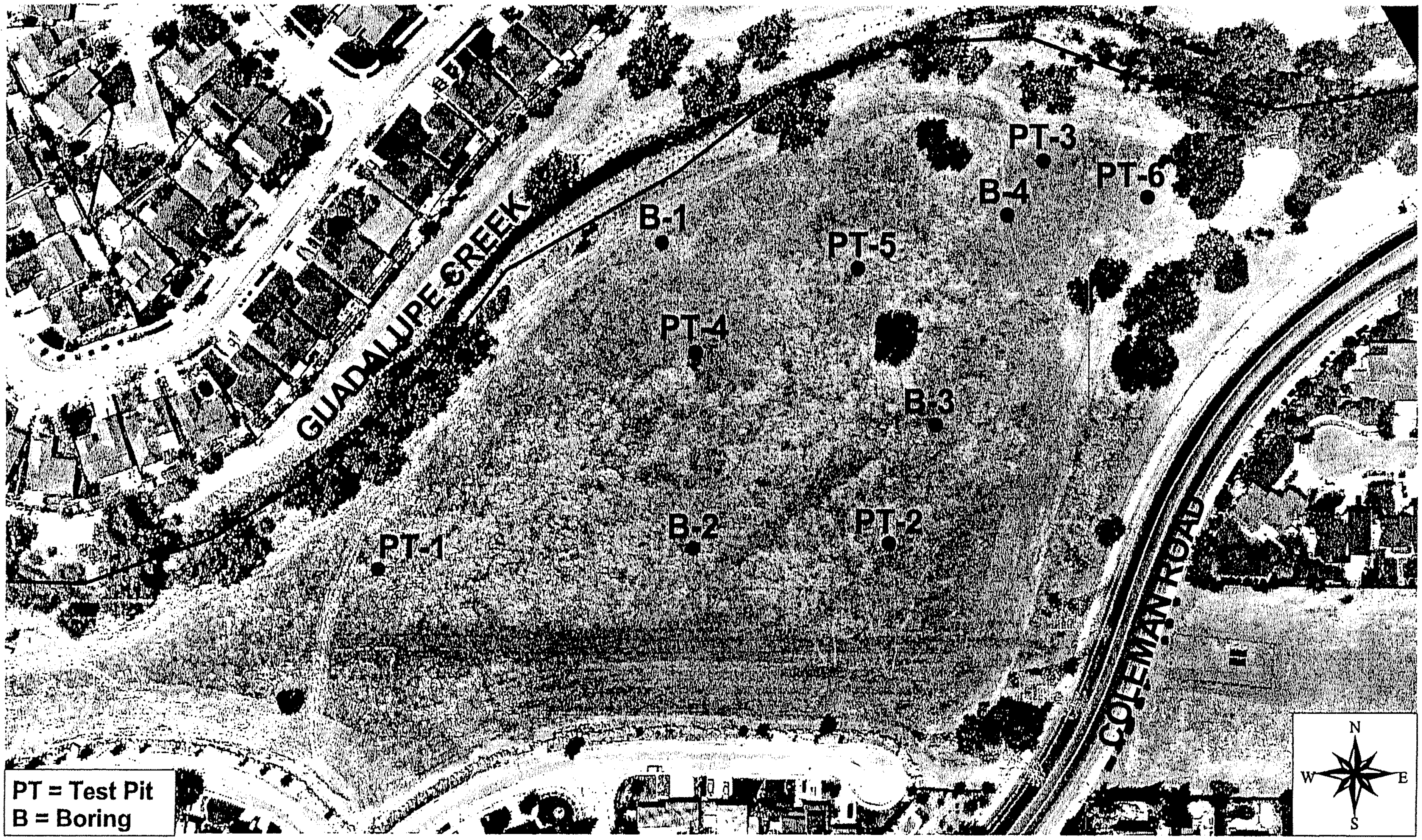
B21t 15 to 26 inches, dark brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate, medium subangular blocky

APPENDIX B

LOS CAPITANCILLOS: FRESHWATER WETLAND MITIGATION

Soil Test Pit Locations
(figure provided by SCVWD)

Los Capitancillos Wetland Mitigation Site



PT = Test Pit
B = Boring

Santa Clara Valley Water District

APPENDIX C

LOS CAPITANCILLOS:
FRESHWATER WETLAND MITIGATION

Soil Test Pits Photographs

Soil and Plant Laboratory, Inc.
www.soilandplantlaboratory.com

352 Mathew Street
Santa Clara, CA 95050
408-727-0330 phone
408-727-5125 fax

SANTA CLARA OFFICE
June 7, 2000
Lab. No.

H. T. HARVEY & ASSOCIATES
3150 Almaden Expressway, Suite 145
San Jose, CA 95118

Attn: Max Busnardo

Re: LOS CAPITANCILLOS

Data only is provided, as requested. Sample descriptions appear at the right on the enclosed data sheet. Please call if you would like assistance utilizing the data.

Rock Percentage Results

Sample #	Description	½ to 1-inch rock (Volume %)	1-inch or larger rock
21	4 to 24-in depth	4.4%	None
22	4 to 6-foot depth	12.5%	37.5%*

* If all rock over ½-inch is considered, the total amount of rock in this sample is 50%.

Jeff Lutton

JEFF LUTTON

Fax 2 pages and mail.

jl

Soil and Plant Laboratory, Inc.

P.O. Box 6566, Orange, California 92613-6566/(714) 282-8777/FAX (714) 282-8575
P.O. Box 153, Santa Clara, California 95052-0153/(408) 727-0330/FAX (408) 727-5125
P.O. Box 1648, Bellevue, Washington 98009-1648/(425) 746-6665/FAX (425) 562-9531

H T HARVEY & ASSOCIATES
3150 Almaden Expressway, Suite 145
San Jose, CA 95118
Attention: Max Busmardo

SOIL FERTILITY AND MICRONUTRIENT ANALYSIS
(A01 or A17)

Santa Clara Office
Lab No. 22729
LOS CAPITANCILLOS
1700-01

Samples Taken: Samples Rec'd: 5/26/00

Data reviewed by ______________________. Recommendations available upon request.

Sample #	Half Sat%/ TEC	pH/ Qual Lime	ECe	NO3 N	NH4 N	PO4 P	K	Ca	Mg	Cu	Zn	Mn	Fe	Sat Ext B ppm	Sat Ext Na eSAR	Sample Description & Log Number
				Parts Per Million Parts Dry Soil												
21	18	6.6	0.5	4	6	29	160	2100	1030	2.2	1	19	38	0.05	1.1	4in.-24in. Depth
	194	None		0.3		1.4	0.8	0.8	3.2	0.7	0.1	1.1	0.5	0.2	0.8	0.7800-A13807 20 4
22	10	6.8	0.5	3	3	14	50	1240	724	1.1	1	6	15	0.06	1.2	4-6 Foot Depth
	124	None		0.3		1.1	0.5	0.9	3.8	0.6	0.2	0.6	0.3	0.2	1.0	0.7100-A13808 20 4

6/ 7/00

Sufficiency factor (1.0=sufficient for average crop) below each nutrient element. N factor based on 200 ppm constant feed. Half Saturation %=approx field moisture capacity. B, Na and salinity(ECe (dS/m at 25 deg.C.)) by sat ext method. Major elements by sodium chloride extraction (phosphorus by sodium bicarbonate extraction). Cu, Zn, Mn & Fe by DTPA extraction. eSAR=Est. Sodiu adsorption ratio. Na=Sodium (meq/l). TEC (listed below Half Sat. when requested)=Estimated Total Exchangeable Cations (meq/kg)

Sample #	Organic Percentage	Gravel Coarse 5-12	Gravel Fine 2-5	Sand Very Coarse 1-2	Sand Coarse 0.5-1	Sand Med. to V. Fine 0.05-.5	Silt .002-.05	Clay 0-.002	USDA Soil Classification
		Percent of Sample Passing 2 mm Screen							
21		8.5	7.8	3.5	4.7	33.6	30.3	27.9	Very Gravelly Loam SO4 = 2.1 meq/l Chem Org = 1.7 % dry wt
22		16.9	20.0	21.0	20.6	32.2	13.3	12.9	Very Gravelly Sandy Loam SO4 = 1.9 meq/l Chem Org = 0.4 % dry wt

6/ 7/00

Half Saturation %=approximate field moisture capacity. Salinity = ECe(dS/m at 25 degree C). Gravel fraction expressed as percent by weight of oven-dried sample passing a 12mm (1/2 inch) sieve. Particle sizes in millimeters.

SOIL TEST PITS TECHNICAL DESCRIPTION FORM

PT-3

PROJECT SITE: LOS CAPITANCILLOS
INVESTIGATOR(S): [illegible]
DATE: 5-25-00
SAMPLE IDENTIFICATION NUMBER: S-3, NE CORNER
SCS SOIL SERIES/PHASE: Sl
SOIL TAXONOMY: ↓
PLANT COMMUNITY:
HISTORICAL/CURRENT LAND USE:
SURFACE HYDROLOGIC CHARACTERISTICS: None
SURFACE TOPOGRAPHIC FEATURES: - flat ~0% slope
NOTES:
→ ROOTS OF [illegible] FOUND AT 54"; [illegible] to North
— [illegible] in Ap Horizon
* A-horizons very shallow
- Stones at surface locally
* MOIST FROM 36" DOWN
✓ NO O-horizon

PROFILE CHARACTERIZATION

Horizon (defined by color, texture, etc.)	Depth (inches)	Textural Class	Soil Color (Munsell)	Coarse Materials Type/% (sand, gravels, stones)	Roots (abundance, size)	Redoxymorphic Features (color, %)	Profile Sketch
Ap	0 ↓ 4"	(Stratified) Sandy loam	7.5YR 3/3	Stones < 5%	few, small	none	0 Ap granular! sticky 4
A1	↓ 13"	Stratified sandy loam	7.5YR 3/2	Stones <1" <5%	f, small		A1 sticky 13
C1	↑ 29"	Sandy loam	7.5YR 3/2		f, med		C1 non sticky 29
C2	56"	Stratified Sand	7.5YR 3/4	Sand 10% G 20 Stones 1-6" 70	few, med		Stratified sand C2 gravel + stones 56
C3	↓ 108"	Stratified [illegible]		Gravel 1/4" 50 Stones 1-11" 50		↓	C3 stratified gravel & stone 108"

Master Horizons and Layers Nomenclature:

O-horizon ; dominated by organic matter, undecomposed or partially decomposed litter

A-horizon ; found at surface or below an O-horizon and either has an accumulation of humified O/M or has properties resulting from cultivation or similar disturbance.; generally darker in color; older taxonomy has it as A1

E-horizon ; primary feature is loss of silicate clay, iron and aluminum; generally lighter in color than underlying B-horizon
it is differentiated from the A-horizon by being lighter in color and containing less O/M
it is differentieated from the B-horizon by color of higher value or low chroma or both or coarser texture; A2 in older taxonomy

B-horizon: generally has illuvial concentration of clay, iron, humus, etc.; generally lower value/higher chroma

C-horizon : generally mineral layers little affected by pedogenic processes
included are sediments, unconsolidated bedrock, etc.

R-horizon ; hard bedrock

MODIFIERS: (t) indicates accumulation of silicate clay (e.g. Bt)
(g) indicates strong gleying
(p) indicates disturbance of layer from tillage or other mechanical means.
(y) indicates accumulation of gypsum (relatively insoluble)
(z) indicates accumulateion of salts (relatively soluble)

SECTIONS: subdivided as A1 (transitional to O), A2 (maximum development of features) or A3 (transitional to E) depending upon degree of accumulation of evidence

SOIL TEST PITS TECHNICAL DESCRIPTION FORM

PT-4

PROJECT SITE: Las Castancilla
INVESTIGATOR(S): Pat B
DATE: 5-25-00
SAMPLE IDENTIFICATION NUMBER: S-4, center
SCS SOIL SERIES/PHASE:
SOIL TAXONOMY: See S1
PLANT COMMUNITY:
HISTORICAL/CURRENT LAND USE:
SURFACE HYDROLOGIC CHARACTERISTICS: None
SURFACE TOPOGRAPHIC FEATURES: Flat
NOTES:

–Organic matter low and restricted to A1

Ap + A1 – clay loam?

PROFILE CHARACTERIZATION

Horizon (defined by color, texture, etc.)	Depth (inches)	Textural Class	Soil Color (Munsell)	Coarse Materials Type/% (sand, gravels, stones)	Roots (abundance, size)	Redoxymorphic Features (color, %)	Profile Sketch
	0						0
Ap	6"	Stony silty loam	10YR 3/3	Stones 5%	few, fine	none	Ap 6"
A1	25	Stony silty clay loam	10YR 3/3 10YR 3/4	Stones ~10%			A1 25"
C1	45	Stony silty loam	10YR 3/3	Stone Sand - 30 Stones ½-2" 30 6"			C1 45"
C2	98	Stratified gravel + stone	10YR 3/3	Stones 1"-12" 50 Gravel 50			C2 98"

Master Horizons and Layers Nomenclature:

O-horizon ; dominated by organic matter, undecomposed or partially decomposed litter

A-horizon ; found at surface or below an O-horizon and either has an accumulation of humified O/M or has properties resulting from cultivation or similar disturbance.; generally darker in color; older taxonomy has it as A1

E-horizon ; primary feature is loss of silicate clay, iron and aluminum; generally lighter in color than underlying B-horizon
it is differentiated from the A-horizon by being lighter in color and containing less O/M
it is differentieated from the B-horizon by color of higher value or low chroma or both or coarser texture; A2 in older taxonomy

B-horizon: generally has illuvial concentration of clay, iron, humus, etc.; generally lower value/higher chroma

C-horizon : generally mineral layers little affected by pedogenic processes
included are sediments, unconsolidated bedrock, etc.

R-horizon ; hard bedrock

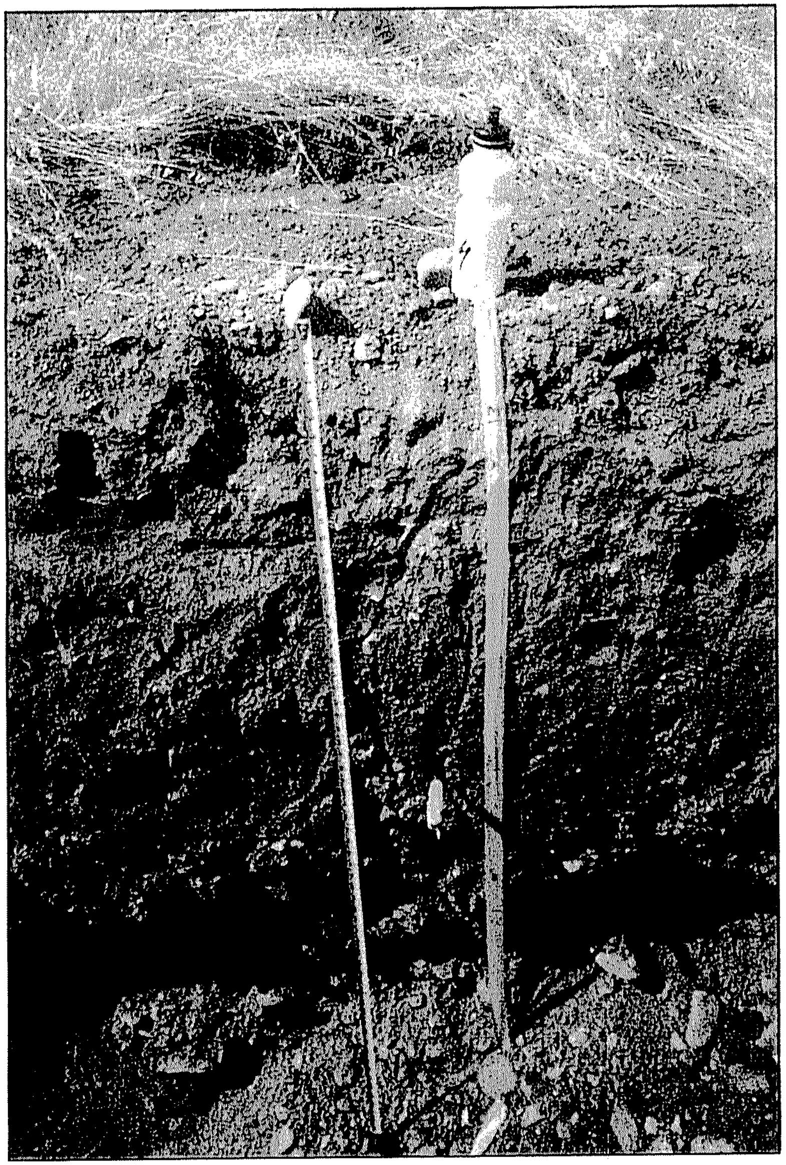
MODIFIERS: (t) indicates accumulation of silicate clay (e.g. Bt)
(g) indicates strong gleying
(p) indicates disturbance of layer from tillage or other mechanical means.
(y) indicates accumulation of gypsum (relatively insoluble)
(z) indicates accumulateion of salts (relatively soluble)

SECTIONS: subdivided as A1 (transitional to O), A2 (maximum development of features) or A3 (transitional to E)
depending upon degree of accumulation of evidence

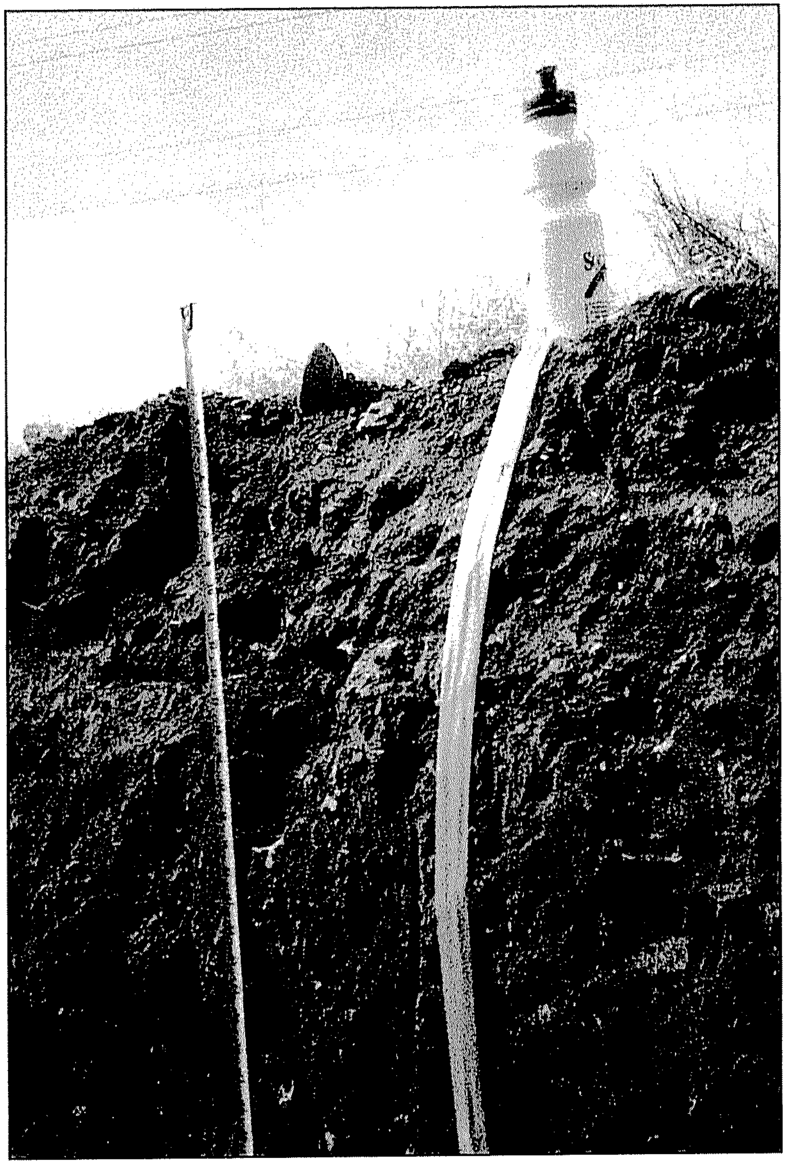
APPENDIX E

LOS CAPITANCILLOS:
FRESHWATER WETLAND MITIGATION

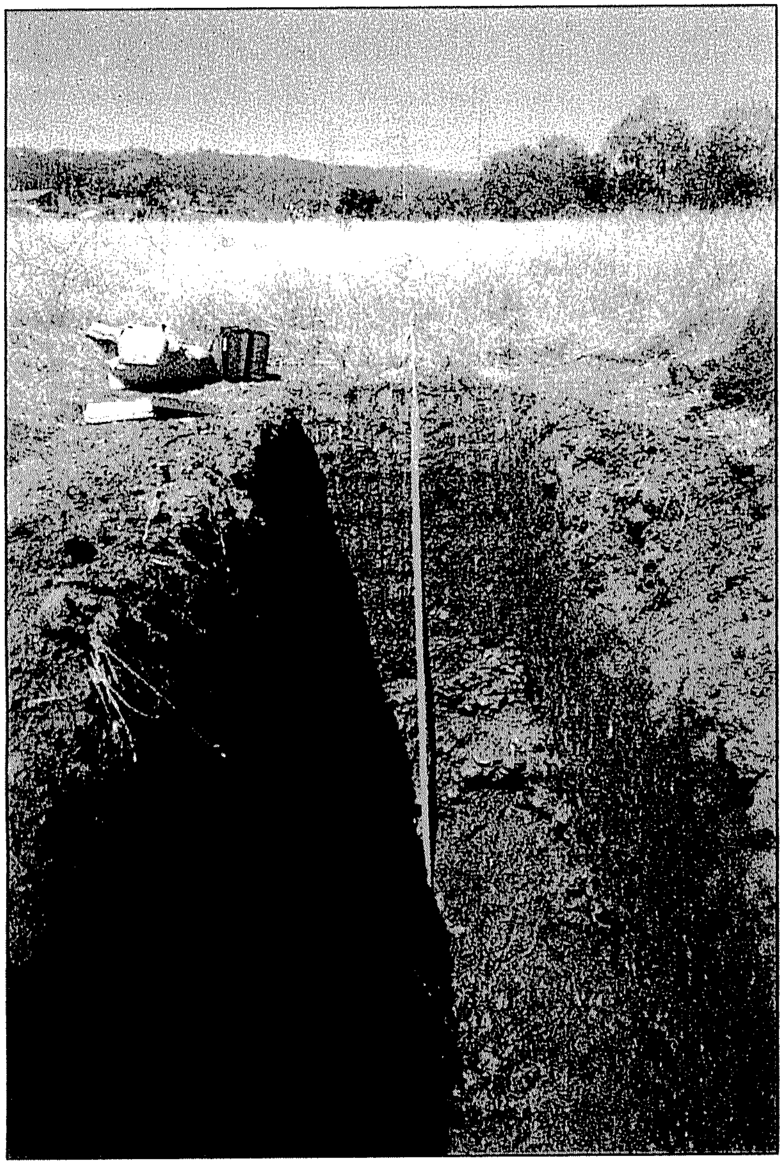
Soil Laboratory Analysis



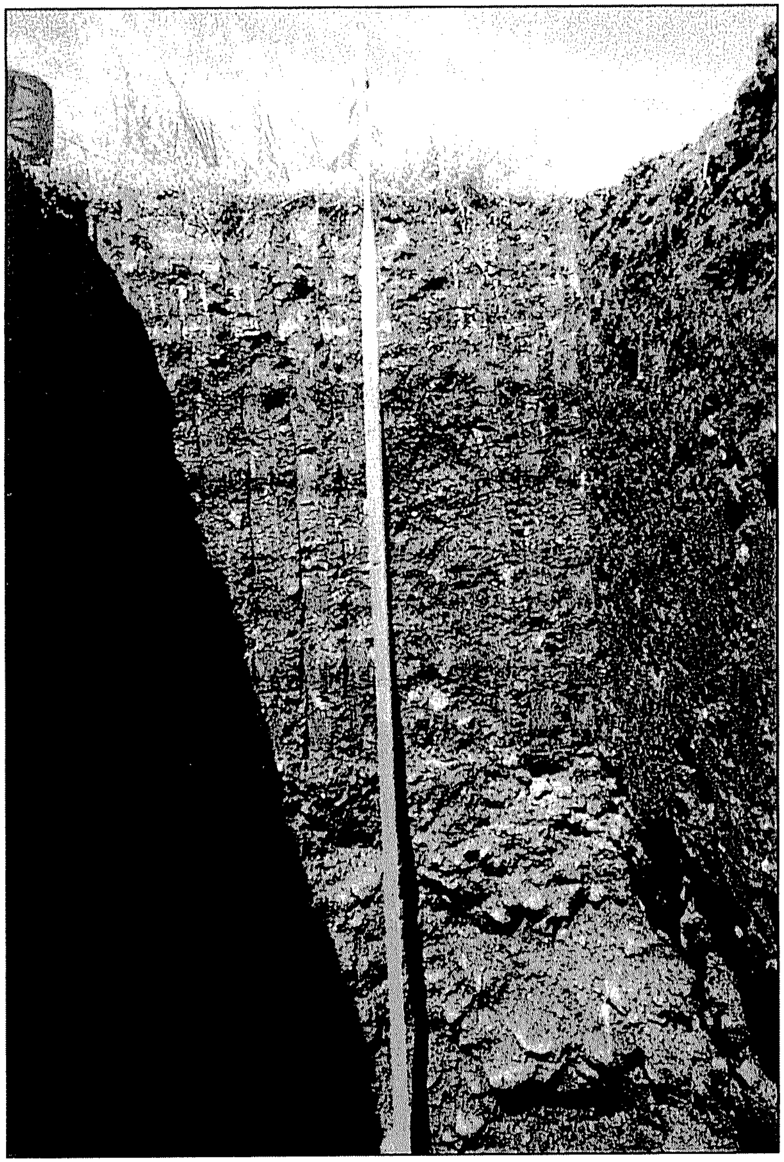
Soil Sample Pit 1



Soil Sample Pit 1

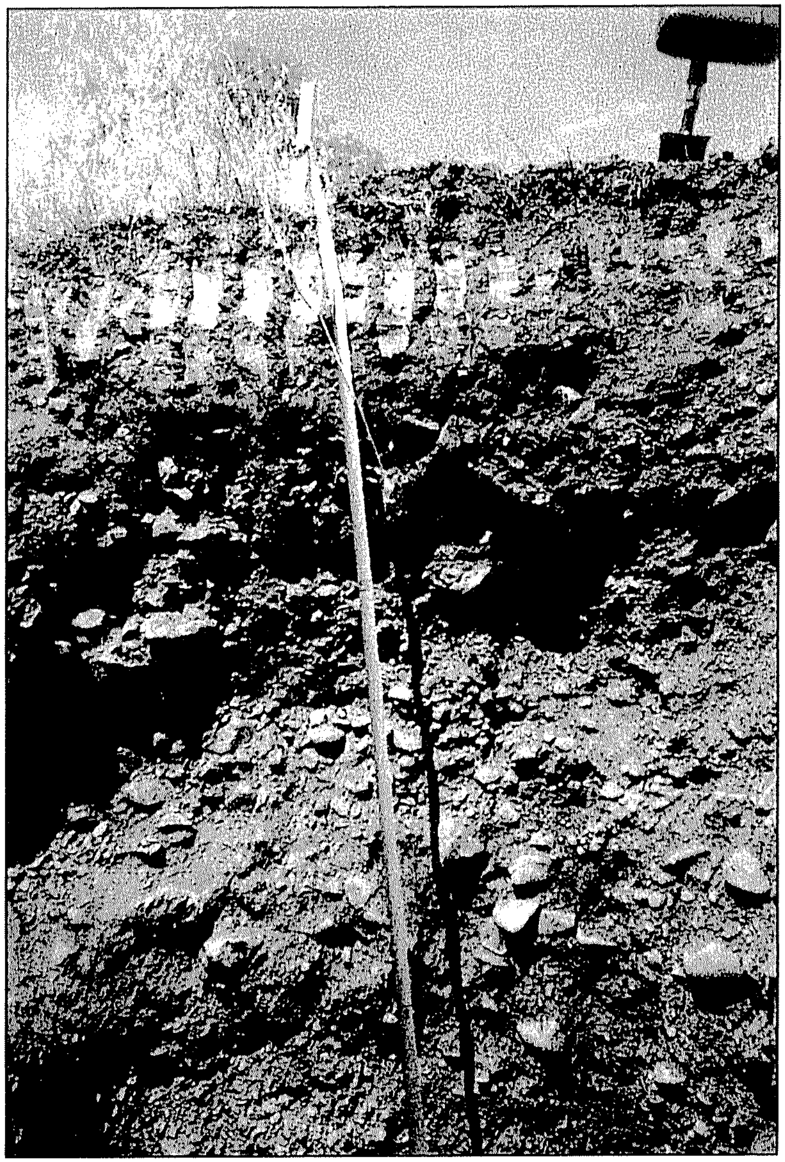


Soil Sample Pit 2

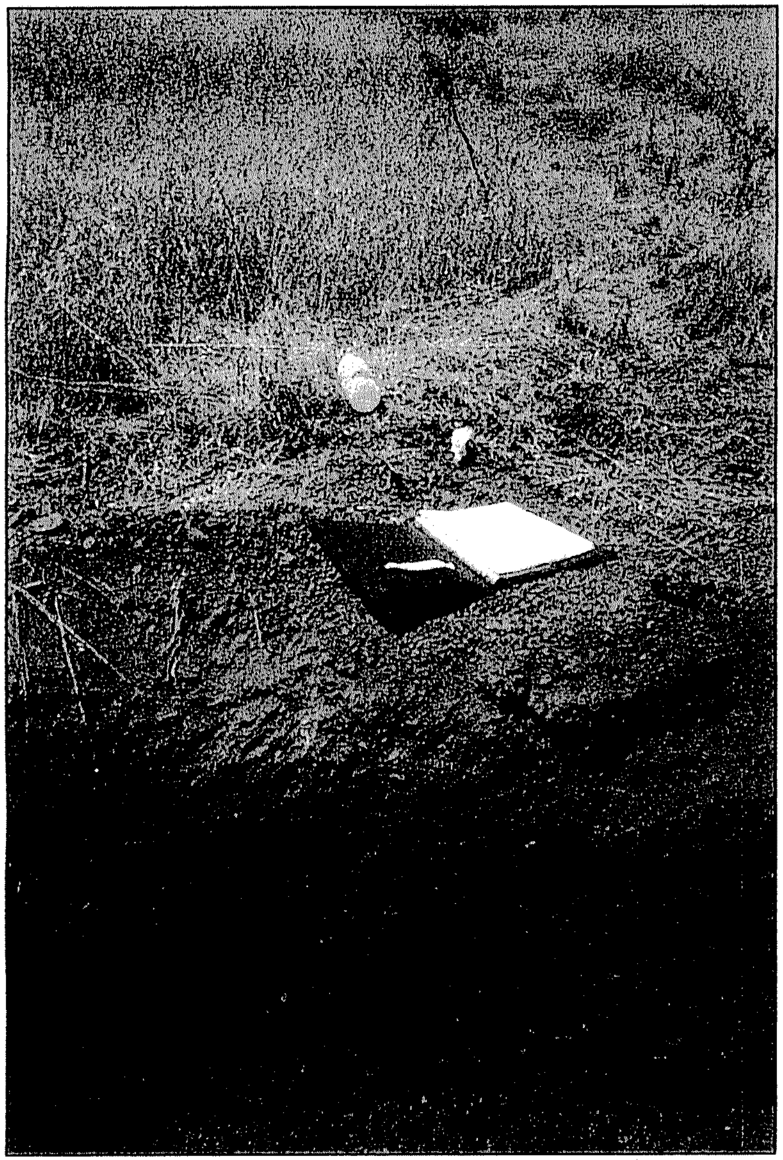


Soil Sample Pit 2

Soil Sample Pit 3



Soil Sample Pit 3



Soil Sample Pit 4

Soil Sample Pit 4

APPENDIX D

LOS CAPITANCILLOS:
FRESHWATER WETLAND MITIGATION

Soil Test Pits Technical Description Forms

SOIL TEST PITS TECHNICAL DESCRIPTION FORM

PT-1

PROJECT SITE: LOS CAPITANCILLOS 1700-01
INVESTIGATOR(S): PATRICK B – PAT R
DATE: 5-25-00
SAMPLE IDENTIFICATION NUMBER: PIT 1, WEST EDGE OF SITE 120 E of TOP OF BANK
SCS SOIL SERIES/PHASE: YA YOLO SILTY CLAY LOAM 0-2% – SURFACE SILTY CLAY LOAM or CL
SOIL TAXONOMY: TYPIC XERORTHENT ∟ entisol
PLANT COMMUNITY: RUDERAL –
HISTORICAL/CURRENT LAND USE: FLOOD PLAIN – ORCHARD
SURFACE HYDROLOGIC CHARACTERISTICS: NO SURFACE @ IT
SURFACE TOPOGRAPHIC FEATURES: FLAT
NOTES:

SURFACE EVIDENCE OF LOCALIZED FILL INCLUDING CONCRETE, BRICK, ASPHALT, SOME GLASS

DOMINATED BY *AVENA & CONVOLVULUS – Hordeum –
Centaurea – Brassica – Raphanus – Erodium – Bromus diandrus – Rumex – P. oak

– excavated to 86"
– ORGANIC MATTER RESTRICTED PRIMARILY TO Ap
Ap – evidence of disking – dense worm holes

PROFILE CHARACTERIZATION

Horizon (defined by color, texture, etc.)	Depth (inches)	Textural Class	Soil Color (Munsell)	Coarse Materials Type/% (sand, gravels, stones)	Roots (abundance, size)	Redoxymorphic Features (color, %)	Profile Sketch
Ap	1	Silt Clay		G(¼;<5%); S(1"<1%)	Few Small	none	Fine Texture
Granular	2		7.5YR3/2				
	4	Loam	7.5YR3/2				
	7				None		
	10	silt clay	10YR2/2	MASSIVE			Massive
A1	16	S Loam	7.5YR3/2				
29	22		7.5YR3/2				
C1	29	Stony/Silt					
43	43	loam					
		Stony Gravelly					Loose
C2	67	Loam	7.5YR4/4	G¼ ST TO 12"		None	Stony
C3		Stratified Sand & Gravelly					
86	86	St Gr		Gravels ½+ S-12"			

Master Horizons and Layers Nomenclature:

O-horizon ; dominated by organic matter, undecomposed or partially decomposed litter
A-horizon ; found at surface or below an O-horizon and either has an accumulation of humified O/M
or has properties resulting from cultivation or similar disturbance.; generally darker in color; older taxonomy has it as A1
E-horizon ; primary feature is loss of silicate clay, iron and aluminum; generally lighter in color than underlying B-horizon
it is differentiated from the A-horizon by being lighter in color and containing less O/M
it is differentieated from the B-horizon by color of higher value or low chroma or both or coarser texture; A2 in older taxonomy
B-horizon: generally has illuvial concentration of clay, iron, humus, etc.; generally lower value/higher chroma
C-horizon : generally mineral layers little affected by pedogenic processes
included are sediments, unconsolidated bedrock, etc.
R-horizon ; hard bedrock

MODIFIERS: (t) indicates accumulation of silicate clay (e.g. Bt)
(g) indicates strong gleying
(p) indicates disturbance of layer from tillage or other mechanical means.
(y) indicates accumulation of gypsum (relatively insoluble)
(z) indicates accumulateion of salts (relatively soluble)

SECTIONS: subdivided as A1 (transitional to O), A2 (maximum development of features) or A3 (transitional to E)
depending upon degree of accumulation of evidence

SOIL TEST PITS TECHNICAL DESCRIPTION FORM

PT-2

PROJECT SITE: LOS CAPITANCILLOS – 1700-01
INVESTIGATOR(S): PAT B. – [illegible]
DATE: 5-23-00
SAMPLE IDENTIFICATION NUMBER: S2 - SE PART OF SITE
SCS SOIL SERIES/PHASE: [illegible] SI
SOIL TAXONOMY:
PLANT COMMUNITY:
HISTORICAL/CURRENT LAND USE:
SURFACE HYDROLOGIC CHARACTERISTICS:
SURFACE TOPOGRAPHIC FEATURES: FLAT
NOTES:

- FEW CINNABAR STONES 12"+
- ORGANIC MATTER [illegible] Ap ~ A1, [illegible] TON

PROFILE CHARACTERIZATION

Horizon (defined by color, texture, etc.)	Depth (inches)	Textural Class	Soil Color (Munsell)	Coarse Materials Type/% (sand, gravels, stones)	Roots (abundance, size)	Redoxymorphic Features (color, %)	Profile Sketch
Ap	0 5	(STONY) SILTY CLAY LOAM	10YR 3/3	STONES 10% <1/4"	few, small	none	GRANULAR CRUMBLY STICKY
A1	5 39	(STONY SILTY CLAY LOAM)	10YR 3/2	STONES <1" 15%	vf, s		MASSIVE STICKY
C1	34 39 50	STONY CLAY LOAM	10YR 3/3 10YR 4/4	STONES 1-4" 20% GRAVEL – 5%	none		SLIGHTLY STICKY LOAM – SEDIMENTED
C2	57 50 71	STRAT'S	10YR 3/4				NON-STICKY STRATIFIED SANDS GRAVELS + STONES?
C3	71 86	S-G'S	10YR 3/4	STONES 2"–24" 50% S+G 50%			

Master Horizons and Layers Nomenclature:

O-horizon ; dominated by organic matter, undecomposed or partially decomposed litter

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R-horizon ; hard bedrock

MODIFIERS:
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SECTIONS: subdivided as A1 (transitional to O), A2 (maximum development of features) or A3 (transitional to E) depending upon degree of accumulation of evidence

Appendix E

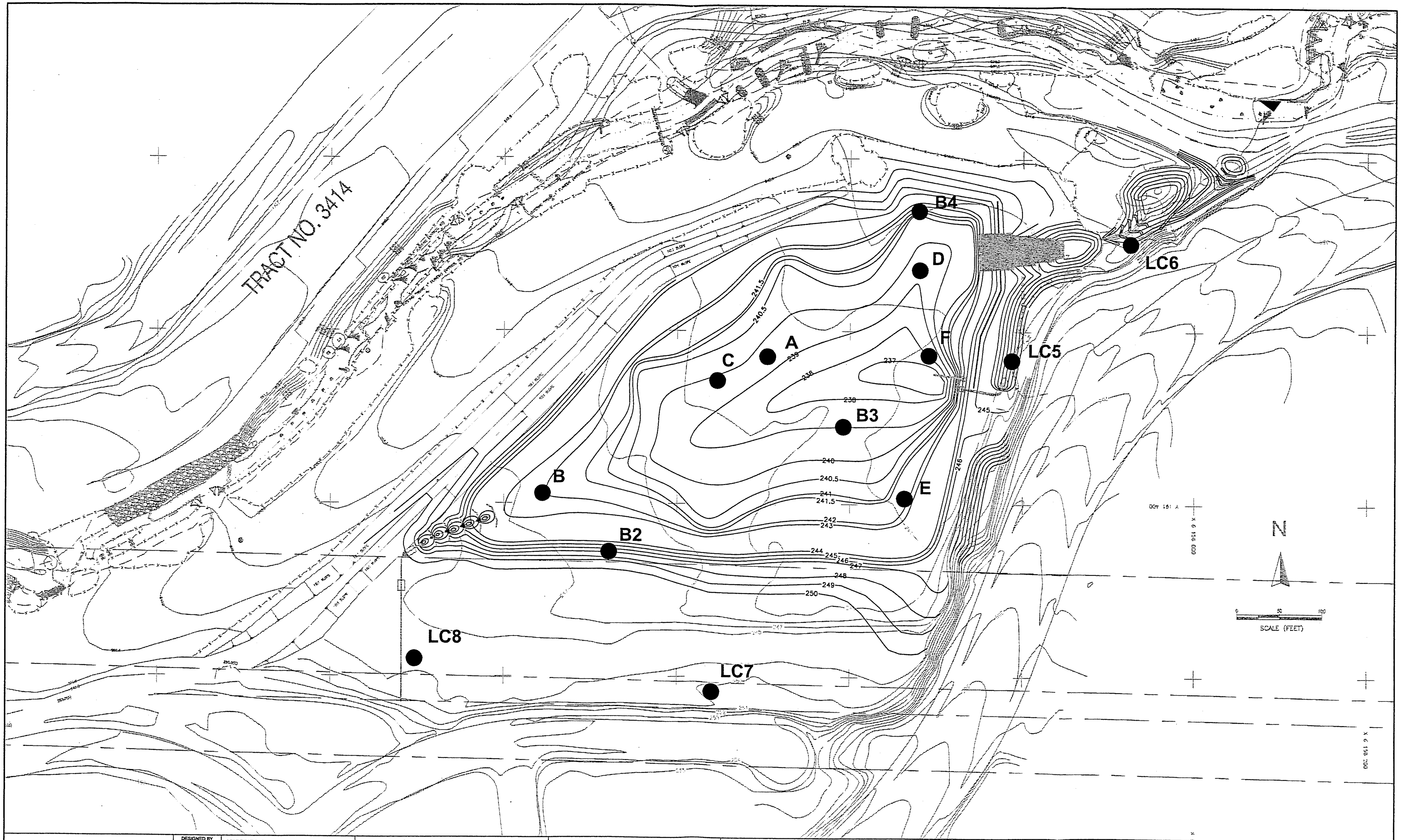
Soil Hazardous Materials Test Results

Los Capitancillos Freshwater Mitigation Project
Mercury Sampling Summary Table

Date	Sample Location	EPA Method	Sample Depth (ft)	Total Hg (mg/kg)	Hg @ Surface	Hg @ 8' bgs
11/29/00	A	7471A	0	1.13	1.13	
11/29/00		7471A	2	0.66		
11/29/00		7471A	4	0.17		
11/29/00		7471A	6	2.13		
11/29/00		7471A	8	0.682		0.682
11/28/00	B	7471A	0	2.04	2.04	
11/28/00		7471A	2	0.95		
11/28/00		7471A	4	1.00		
11/28/00		7471A	6	1.45		
11/28/00		7471A	8	0.682		0.682
11/29/00	C	7471A	0	2.07	2.07	
11/29/00		7471A	2	3.06		
11/29/00		7471A	4	0.996		
11/29/00		7471A	6	3.29		
11/29/00		7471A	8	0.061		0.061
11/28/00	D	7471A	0	15.0	15.0	
11/28/00		7471A	2	3.00		
11/28/00		7471A	4	1.76		
11/28/00		7471A	6	2.27		
11/28/00		7471A	8	1.17		1.170
11/28/00	E	7471A	0	0.552	0.552	
11/28/00		7471A	2	0.820		
11/28/00		7471A	4	1.27		
11/28/00		7471A	6	0.895		
11/28/00		7471A	8	0.203		0.203
11/28/00	F	7471A	0	2.35	2.35	
11/28/00		7471A	2	0.865		
11/28/00		7471A	4	0.570		
11/28/00		7471A	6	1.040		
11/28/00		7471A	8	0.502		0.502
5/25/00	Test Pit 1	7471A	0.5	6.62	6.62	
5/25/00		7471A	4	0.359		
5/25/00	Test Pit 4	7471A	0.5	3.36	3.36	
5/25/00		7471A	4	0.129		
5/26/00	B1	7471A	0.5	1.54	1.54	
5/26/00		7471A	2	0.64		
5/26/00		7471A	4	0.14		
5/26/00		7471A	8	0.185		0.185

Los Capitancillos Freshwater Mitigation Project
Mercury Sampling Summary Table (continued)

Date	Sample Location	EPA Method	Sample Depth (ft)	Total Hg (mg/kg)	Hg @ Surface	Hg @ 8' bgs
6/14/00	B2	7471A	0.5	1.75	1.75	
6/14/00		7471A	2	0.58		
6/14/00		7471A	4	1.4		
6/14/00		7471A	8	0.235		0.235
5/26/00	B3	7471A	0.5	1.41	1.41	
5/26/00		7471A	2	0.538		
5/26/00		7471A	4	0.106		
5/26/00		7471A	8	0.177		0.177
6/14/00	B4	7471A	0.5	8.02	8.02	
6/14/00		7471A	2	5.22		
6/14/00		7471A	4	0.45		
6/14/00		7471A	8	<0.02		<0.02
6/20/00	LC5	7471A	0.5	1.8	1.8	
6/20/00		7471A	2	1.4		
6/20/00	LC6	7471A	0.5	12	12	
6/20/00		7471A	2	9.9		
6/20/00	LC7	7471A	0.5	8.3	8.3	
6/20/00	LC8	7471A	0.5	1.1	1.1	
		Minimum		**<0.02**	**0.552**	**<0.02**
		Maximum		**15.0**	**15.0**	**1.17**
		Average		**2.18**	**4.32**	**0.43**



FILENAME: Q:\Projects\1426 Guadalupe Creek\MercurySamples.dwg
PLOT SCALE: 1=1

REVISIONS			
NO.	DATE	BY	DESCRIPTION

DESIGNED BY MRL
DRAWN BY EBH
CHECKED BY AEB
IN CHARGE EA

CERTIFICATIONS:

APPROVED ____________ DATE

APPROVED ____________ DATE

Los Capitancillos
Freshwater Wetland Mitigation Project
Santa Clara Valley Water District

PREPARED BY:

PWA
PHILIP WILLIAMS & ASSOCIATES, LTD.
720 CALIFORNIA STREET, SUITE 600
SAN FRANCISCO, CALIFORNIA 94108
PHONE (415) 262-2300 FAX (415) 262-2303

IN COOPERATION WITH:

Mercury Samples

DATUM	SCALE	CONTOUR INTERVAL	DATE	JOB NO.	SHEET	OF
NGVD '29	1"=50'	1'	03/08/02	1426-06	x	x

Table 1
Mercury in Soils from Los Capitancillos Area

Depth	Test Pit 1	Test Pit 4	B1	B2	B3	B4	LC5	LC6	LC7	LC8
6 in	6.62	3.36	1.54	1.75	1.41	8.02	1.8	12	8.3	1.1
2 ft			0.64	0.58	0.538	5.22	1.4	9.9		
4 ft	0.359	0.129	0.14	1.4	0.106	0.45				
8ft			0.185	0.235	0.177	<0.02				

Units are mg/kg. Total mercury was analyzed using EPA Method 7471A.

Date are from Snata Clara Valley Water District. Samples were collected on 6/14/00 and on 6/20/00 for LC 5-8.

Samples LC1 through LC4 were collected from the surface above the Los Capitancillos near the creek bank. Mercury in these samples ranged from 6.9 to 160 mg/kg.

Table 2. Mercury in Soils from Proposed Wetland Area

Sample ID	Depth, ft	Total Hg, mg/kg	Hg at Surface	Hg at 8 ft
BH-A-S	0.00	1.13	1.13	
BH-A-2	2	0.66		
BH-A-4	4.00	0.17		
BH-A-6	6.00	2.13		
BH-A-8	8.00	0.682		0.682
BH-B-S	0.00	2.04	2.04	
BH-B-2	2	0.95		
BH-B-4	4.00	1		
BH-B-6	6.00	1.45		
BH-B-8	8.00	0.682		0.682
BH-C-S	0.00	2.07	2.07	
BH-C-2	2.00	3.06		
BH-C-4	4.00	0.996		
BH-C-6	6.00	3.29		
BH-C-8	8.00	0.0609		0.0609
BH-D-S	0.00	15	15	
BH-D-2	2.00	3		
BH-D-4	4.00	1.76		
BH-D-6	6.00	2.27		
BH-D-8	8.00	1.17		1.17
BH-E-S	0.00	0.552	0.552	
BH-E-2	2.00	0.82		
BH-E-4	4.00	1.27		
BH-E-6	6.00	0.895		
BH-E-8	8.00	0.203		0.203
BH-F-S	0.00	2.35	2.35	
BH-F-2	2.00	0.865		
BH-F-4	4.00	0.57		
BH-F-6	6.00	1.04		
BH-F-8	8.00	0.502		0.502
	Average	1.75	3.85	0.54

Samples were collected in November 2000 at the locations marked as A-F in Figure 1.
Mercury was analysed using EPA Method 7471A.
Data were included in the HSLA (Kleinfelder 2001).

Table 4
WET Leaching Test Results for Soil from Los Capitancillos Area

Metal	LC5 at 6 in	LC5 at 2 ft	LC6 at 6 in	LC6 at 2 ft	LC7 at 0 ft	LC8 at 0 ft
Antimony	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Barium	8.95	9.99	8.05	6.77	12.2	9.66
Beryllium	<0.0.02	<0.0.02	<0.0.02	<0.0.02	<0.0.02	<0.0.02
Cadmium	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chromium	0.295	0.51	0.51	0.434	0.357	0.391
Cobalt	0.667	0.842	0.842	0.645	0.667	0.87
Copper	0.138	0.141	0.14	0.12	0.465	0.163
Lead	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Mercury	0.000228	<0.0002	0.00351	0.00221	0.000611	<0.0002
Molybdenu	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	1.77	2.93	2.93	2.4	2.15	2.08
Selenium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Silver	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Thallium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Vanadium	0.277	0.339	0.339	0.316	0.262	0.365
Zinc	0.891	1.04	1.04	0.868	1.1	1.2

Units are mg/L. Metals were analyzed using WET leaching procedure and EPA Method 6010A.
Data from Santa Clara Valley Water District. Samples LC5 through LC8 were collected 6/20/2000

Table 3
Other Metals in Los Capitancillos Soils

Metal	B-1 at 6 in	B-1 at 2 ft	B-1 at 4 ft	B-1 at 8 ft	B-2 at 6 in	B-2 at 2 ft	B-2 at 4 ft	B-2 at 8 ft	B-3 at 6 in	B-3 at 2 ft	B-3 at 4 ft	B-3 at 10 ft
Antimony	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Arsenic	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Barium	142	150	57	85	146	174	143	83.1	146	186	63.7	85.5
Beryllium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	108	131	43.2	66.1	129	111	94.5	96.5	96.9	131	127	22.9
Cobalt	20.3	21.1	7.99	12.8	22.9	20.9	18	13.8	18.8	22.5	13.7	5.52
Copper	30.7	36.6	23.7	9.83	34.8	32.6	35.6	26.4	150	33.2	41.4	26.2
Lead	9.09	<5	<5	<5	15.3	7.95	6.28	5.78	8.17	<5	<5	<5
Molybdenur	<2.5	<2.5	<2.5	<2.5	<2.50	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Nickel	148	171	52.6	90.5	189	159	134	127	139	172	104	29.2
Selenium	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Silver	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Thallium	<5	<5	<5	<5	28.8	<5	27.2	26.2	<5	<5	<5	<5
Vanadium	60.5	66.2	38.9	47.8	59	55.7	52.1	50.7	54.2	62.6	28.9	29.7
Zinc	52.7	60.5	44.3	43.6	64.1	55.5	55.3	50.1	60.4	62.4	62.4	35.3

Metal	B-4 at 6 in	B-4 at 2 ft	B-4at 4 ft	B-4 at 8 ft	PT-1 at 6 in	PT-1 at 4 ft	PT-4 at 6 in	PT-4 at 4 ft	LC5 at 6 in	LC5 at 2 ft	LC6 at 6 in	LC6 at 2 ft	LC7 at 0 ft	LC8 at 0 ft
Antimony	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Arsenic	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Barium	132	81.1	77	59.3	176	106	163	68.5	139	146	129	100	102	130
Beryllium	<0.5	<0.5	<0.5	<0.5	<0.5	42.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	157	72.6	80.9	53.1	127	82.2	139	59.6	79.3	91.4	106	83.9	98.8	85.3
Cobalt	24.2	14.2	13	13.1	22.3	15.7	21.1	14.4	15.4	17.2	19.5	15.3	16.7	15.8
Copper	32.5	26.9	25.4	56.,8	33.4	23.5	30.5	19.7	23.7	26.3	27.7	21.3	25.7	25.2
Lead	10.9	<5	<5	<5	5.38	<5	6.3	<5	<5	<5	8.03	<5	6.37	7.03
Molybdenur	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Nickel	218	91.1	91.5	70.3	175	97.9	163	85.2	114	126	168	127	140	128
Selenium	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Silver	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Thallium	30.2	18.7	20.1	18.7	<5	<5	<5	<5	12	14.9	16.3	12	14.2	13.1
Vanadium	60.1	41.3	44.3	41.6	63.2	51.1	62	56.4	44.6	50.5	51.3	41.4	47	46.4
Zinc	60	72.8	42.3	66.3	55.2	42.7	54.9	40.5	44.1	45.1	49.8	38.7	45	48.8

Units are mg/kg. Metals were analyzed using EPA Method 6010A.
Data from Santa Clara Valley Water District. Samples B-1, B-3, PT-1, and PT-4 were collected 5/25-26/2000. Samples B-2 and B-4 were collected 6/14/2000.

Table 5. Metals in Soils from Proposed Wetland Area

Metal	Units	EPA Method	A at Surf. 11/29/00	A at 6 in. 11/29/00	A at 2 ft. 11/29/00	A at 4 ft. 11/29/00	A at 8 ft. 11/29/00	B at Surf. 11/28/00	B at 6 in. 11/28/00	B at 2 ft. 11/28/00	B at 4 ft. 11/28/00	B at 8 ft. 11/28/00	C at Surf. 11/29/00	C at 6 in. 11/29/00	C at 2 ft. 11/29/00	C at 4 ft. 11/29/00	C at 8 ft. 11/29/00
Mercury	mg/kg	7471A	1.13	2.13	0.66	0.17	0.682	2.04	1.45	0.946	1	0.745	2.07	3.29	3.06	0.996	0.0609
Antimony	mg/kg	6010A	<4.86	<4.9	<5.31	<4.9	<5.26	<5.43	<5.43	<5.1	<4.77	<4.64	<5.31	<5.43	<4.6	<5.1	<5.2
Arsenic	mg/kg	6010A	30.1	35.9	41	42.2	38.2	35.1	39.5	37.3	33.2	38.1	36.1	36.4	39.6	40.5	37.1
Barium	mg/kg	6010A	124	164	184	111	133	156	166	178	161	138	156	170	149	158	91.6
Beryllium	mg/kg	6010A	<0.486	<0.49	<0.531	<0.49	<0.526	<0.543	<0.543	<0.51	<0.477	<0.464	<0.531	<0.543	<0.46	<0.51	<0.52
Cadmium	mg/kg	6010A	<0.486	<0.49	<0.531	<0.49	<0.526	<0.543	<0.543	<0.51	<0.477	<0.464	<0.531	<0.543	<0.46	<0.51	<0.52
Chromium	mg/kg	6010A	109	146	141	225	142	127	137	138	101	158	151	171	121	140	166
Cobalt	mg/kg	6010A	20	25.4	26	23.9	23.4	23.6	26.1	24.3	21.2	23.2	24.7	26.5	23.2	24.2	19.7
Copper	mg/kg	6010A	25	32.7	32.5	27.8	30.3	28.9	31.5	32.9	26.5	29.9	31.1	32.4	33.9	32.3	24.6
Lead	mg/kg	6010A	13.4	15.1	8.4	<4.9	7.3	14.5	15.6	9.67	8.15	7.68	14.5	14.6	8.23	8.41	8.08
Molybdenum	mg/kg	6010A	<2.43	<2.45	<2.66	<2.45	<2.63	<2.71	<2.71	<2.55	<2.38	<2.32	<2.66	<2.71	<2.3	<2.55	<2.6
Nickel	mg/kg	6010A	140	187	197	180	160	159	179	184	157	185	180	195	166	170	205
Selenium	mg/kg	6010A	<4.86	<4.9	<5.31	<4.9	<5.26	<5.43	<5.43	<5.1	<4.77	<4.64	<5.31	<5.43	<4.6	<5.1	<5.2
Silver	mg/kg	6010A	<0.486	3.09	<0.531	<0.49	<0.526	<0.543	0.559	<0.51	<0.477	<0.464	<0.531	3.64	<0.46	0.576	<0.52
Thallium	mg/kg	6010A	19.3	29	31.3	23.3	27.9	22.2	28.8	31.5	29.3	32	27	27.2	33.4	33.2	28.5
Vanadium	mg/kg	6010A	56	72.6	74.1	66.9	76.2	72.7	76.1	71.9	61.3	70	71	74.8	72	81.8	66
Zinc	mg/kg	6010A	53.2	61	61.2	48.6	54.8	58.4	63.3	61.1	52.1	56.7	60.6	61.3	60.6	60.7	51

Metal	Units	EPA Method	D at Surf. 11/28/00	D at 6 in. 11/28/00	D at 2 ft. 11/28/00	D at 4 ft. 11/28/00	D at 8 ft. 11/28/00	E at Surf. 11/28/00	E at 6 in. 11/28/00	E at 2 ft. 11/28/00	E at 4 ft. 11/28/00	E at 8 ft. 11/28/00	F at Surf. 11/28/00	F at 6 in. 11/28/00	F at 2 ft. 11/28/00	F at 4 ft. 11/28/00	F at 8 ft. 11/28/00
Mercury	mg/kg	7471A	15	2.27	3	1.76	1.17	0.552	0.895	0.82	1.27	0.203	2.35	1.04	0.865	0.57	0.502
Antimony	mg/kg	6010A	<5.2	<5.26	<5	<5.26	<5	<5.48	<5.31	<5.31	<4.72	<5.37	<4.95	<5.05	<5.2	<5.2	<5.48
Arsenic	mg/kg	6010A	25.5	39.8	37.6	38	32.2	21.3	22	38.5	35.5	30	37.8	36.8	41	40.5	41.2
Barium	mg/kg	6010A	115	169	161	136	106	96.9	89.8	190	141	127	154	165	177	141	119
Beryllium	mg/kg	6010A	<0.52	<0.526	<0.5	<0.526	<0.5	<0.548	<0.531	<0.531	<0.472	<0.537	<0.495	<0.505	<0.52	<0.52	<0.548
Cadmium	mg/kg	6010A	<0.52	<0.526	<0.5	<0.526	<0.5	<0.548	<0.531	<0.531	<0.472	<0.537	<0.495	<0.505	<0.52	<0.52	<0.548
Chromium	mg/kg	6010A	170	139	129	131	99.5	526	158	379	223	129	119	126	155	143	124
Cobalt	mg/kg	6010A	25.3	26.8	23.6	23.4	19.5	48.5	24	41.7	29.7	20.3	24.4	24.7	27.5	22.7	22
Copper	mg/kg	6010A	27.4	31.3	29.4	27	27.2	21.9	18.4	28.2	25.3	24.8	29.8	31.8	36.7	29.2	26.5
Lead	mg/kg	6010A	9.97	10.1	9.1	7.12	7.42	10.1	9.43	10.3	8.63	7.23	14.8	13.7	9.34	8.33	7.39
Molybdenum	mg/kg	6010A	<2.6	<2.63	<2.5	<2.63	<2.5	<2.74	<2.66	<2.66	<2.36	<2.68	<2.48	<2.52	<2.6	<2.6	<2.74
Nickel	mg/kg	6010A	209	187	176	155	110	739	264	467	347	179	155	168	189	154	126
Selenium	mg/kg	6010A	<5.2	<5.26	<5	<5.26	<5	<5.48	<5.31	<5.31	<4.72	<5.37	<4.95	<5.05	<5.2	<5.2	<5.48
Silver	mg/kg	6010A	<0.52	<0.526	<0.5	<0.526	<0.5	<0.548	<0.531	<0.531	<0.472	<0.537	<0.495	<0.505	<0.52	<0.52	<0.548
Thallium	mg/kg	6010A	33.4	33.3	28.3	28.7	25.4	37.7	21.3	42.5	31.7	24.9	26.1	26.7	31.8	28.9	24.9
Vanadium	mg/kg	6010A	58.1	77.6	73	72.2	64.1	49	43.9	73.4	64	61.5	81.1	73.5	84.2	77.5	81.1
Zinc	mg/kg	6010A	55.1	65.5	59	56.9	54.2	50.2	39.8	60.1	53.6	54.5	60.3	60.2	62.5	56.4	56.9

Data from Kleinfelder 2001.

Table 6. WET Leaching Test Results for Recent Soil Samples in Proposed Wetland Area

Metal	Units	EPA Method	A at Surf. 11/29/00	A at 6 in. 11/29/00	A at 2 ft. 11/29/00	A at 4 ft. 11/29/00	A at 8 ft. 11/29/00	B at Surf. 11/28/00	B at 6 in. 11/28/00	B at 2 ft. 11/28/00	B at 4 ft. 11/28/00	B at 8 ft. 11/28/00	C at Surf. 11/29/00	C at 6 in. 11/29/00	C at 2 ft. 11/29/00	C at 4 ft. 11/29/00	C at 8 ft. 11/29/00
Mercury	mg/L	7470A	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Antimony	mg/L	6010A	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Arsenic	mg/L	6010A	0.507	0.526	0.512	0.518	0.545	0.587	0.509	0.553	0.584	<0.5	<0.5	0.527	<0.5	<0.5	0.531
Barium	mg/L	6010A	8.89	9.03	10.4	7.84	7.99	9.34	9.47	9.84	9.83	8.36	7.54	8.17	8.52	8.58	6.41
Beryllium	mg/L	6010A	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium	mg/L	6010A	<0.05	<0.05	<0.05	<0.05	<0.05	,0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chromium	mg/L	6010A	0.353	0.333	0.236	0.256	0.29	0.401	0.351	0.377	0.926	0.446	0.304	0.316	0.254	0.235	0.228
Cobalt	mg/L	6010A	0.843	0.847	0.872	0.521	0.59	0.825	0.847	0.893	0.917	0.569	0.728	0.752	0.554	0.546	0.331
Copper	mg/L	6010A	0.136	0.13	0.115	0.132	0.119	0.144	0.139	0.091	0.126	0.15	0.117	0.116	0.102	0.1	0.127
Lead	mg/L	6010A	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Molybdenum	mg/L	6010A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nickel	mg/L	6010A	2.3	2.44	2.39	1.46	1.65	2.04	2.22	2.64	2.8	1.47	1.96	2.23	1.54	1.5	0.92
Selenium	mg/L	6010A	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Silver	mg/L	6010A	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Thallium	mg/L	6010A	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Vanadium	mg/L	6010A	0.285	0.265	0.287	0.243	0.25	0.342	0.326	0.318	0.419	0.298	0.253	0.244	0.21	0.21	0.203
Zinc	mg/L	6010A	1.12	1.1	0.953	0.531	0.573	1.21	1.14	1.18	1.2	0.707	0.716	0.661	0.944	0.984	0.513

Metal	Units	EPA Method	D at Surf. 11/28/00	D at 6 in. 11/28/00	D at 2 ft. 11/28/00	D at 4 ft. 11/28/00	D at 8 ft. 11/28/00	E at Surf. 11/28/00	E at 6 in. 11/28/00	E at 2 ft. 11/28/00	E at 4 ft. 11/28/00	E at 8 ft. 11/28/00	F at Surf. 11/28/00	F at 6 in. 11/28/00	F at 2 ft. 11/28/00	F at 4 ft. 11/28/00	F at 8 ft. 11/28/00
Mercury	mg/L	7470A	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Antimony	mg/L	6010A	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Arsenic	mg/L	6010A	0.534	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.505	<0.5	<0.5	<0.5	<0.5
Barium	mg/L	6010A	8.08	12.5	8.82	9.09	7.06	6.42	7.24	7.7	8.11	7.89	8.07	8.23	7.94	8.14	6.82
Beryllium	mg/L	6010A	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium	mg/L	6010A	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chromium	mg/L	6010A	0.485	0.344	0.534	0.683	0.179	0.79	0.526	0.604	0.781	0.294	0.35	0.312	0.31	0.286	0.237
Cobalt	mg/L	6010A	0.782	0.662	0.751	0.698	0.385	1.81	1.09	1.13	1.04	0.537	0.776	0.682	0.693	0.528	0.385
Copper	mg/L	6010A	0.135	0.149	0.154	0.155	0.128	0.103	0.0885	0.084	0.103	0.089	0.108	0.0825	0.0735	0.097	0.089
Lead	mg/L	6010A	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Molybdenum	mg/L	6010A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nickel	mg/L	6010A	2.95	2.11	2.38	2.02	0.885	3.76	2.73	2.95	2.92	1.33	2.18	2.07	2.01	1.39	1
Selenium	mg/L	6010A	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Silver	mg/L	6010A	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Thallium	mg/L	6010A	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Vanadium	mg/L	6010A	0.334	0.257	0.318	0.364	<0.2	<0.2	<0.2	<0.2	0.229	0.212	0.247	0.217	0.24	0.224	<0.2
Zinc	mg/L	6010A	0.788	0.796	0.75	0.697	0.627	0.661	0.611	0.645	0.679	0.584	1.01	1.1	0.6	0.703	0.518

Data from Kleinfelder, 2001.

Appendix F

Soil Cover Specifications

PWA
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MEMORANDUM

DATE: March 22, 2002

TO: Files

FROM: Mark Lindley and Max Busnardo (HTH)

RE: Los Capitancillos Freshwater Wetland Mitigation Project
Clean Soil Cover Specifications
PWA Ref. #: 1426

The soil utilized for wetland cover must meet both the San Francisco Bay Regional Water Quality Control Board (RWQCB) sediment contaminant screening guidelines and project design specifications for soil texture and permeability. To increase the likelihood of locating sufficient quantities of soil meeting both the RWQCB guidelines and soil specifications, three separate sets of soil specifications are proposed. Each soil cover specification is tailored to support different hydrologic and ecologic functions at the proposed mitigation site.

San Francisco Bay RWQCB Sediment Contaminant Screening Guidelines

All soil utilized for wetland cover must meet the following RWQCB sediment contaminant screening guidelines included in the Beneficial Reuse of Dredged Materials: Draft Sediment Screening and Testing Guidelines, May 2000.

San Francisco Bay RWQCB Sediment Contaminant Screening Guidelines

ANALYTE	Wetland Surface Material		Wetland Foundation Material	
	Concentration	Decision Basis	Concentration	Decision Basis
Metals (mg/kg)				
Arsenic	15.3	Ambient Values	70	ER-M
Cadmium	0.33	Ambient Values	9.6	ER-M
Chromium	112	Ambient Values	370	ER-M
Copper	68.1	Ambient Values	270	ER-M
Lead	43.2	Ambient Values	218	ER-M
Mercury	0.43	Ambient Values	0.7	ER-M
Nickel	112	Ambient Values	120	ER-M
Selenium	0.64	Ambient Values		
Silver	0.58	Ambient Values	3.7	ER-M
Zinc	158	Ambient Values	410	ER-M
Organochlorine Pesticides/PCBS (µg/kg)				
DDTS,sum	7.0	Ambient Values	46.1	ER-M
Chlordanes,sum	2.3	TEL	4.8	PEL
Dieldrin	0.72	TEL	4.3	PEL
Hexachlorocyclohexane,sum	0.78	Ambient Values		
Hexachlorobenzene	0.485	Ambient Values		
PCBs, sum	22.7	ER-L	180	ER-M
Polycyclic Aromatic Hydrocarbons (µg/kg)				
PAHs total	3,390	Ambient Values	44,792	ER-M
Low molecular weight PAH's, sum	434	Ambient Values	3,160	ER-M
High molecular weight PAH's, sum	3,060	Ambient Values	9,600	ER-M
1-Methylnaphthalene	12.1	Ambient Values		
1-Methylphenanthrene	31.7	Ambient Values		
2,3,5,-Trimethlynaphthalene	9.8	Ambient Values		
2,6 – Dimethylnaphthalene	12.1	Ambient Values		
2-Methylnaphthalene	19.4	Ambient Values	670	ER-M
2- Methylphenanthrene		Ambient Values		
3- Methylphenanthrene		Ambient Values		
Acenaphthene	26.0	Ambient Values	500	ER-M
Acenaphthylene	88.0	Ambient Values	640	ER-M
Anthracene	88.0	Ambient Values	1,100	ER-M
Benz(a)anthracene	412	Ambient Values	1,600	ER-M
Benzo(a)pyrene	371	Ambient Values	1,600	ER-M
Benzo(c)pyrene	294	Ambient Values		
Benzo(b)fluoranthene	371	Ambient Values		
Benzo(g,h,i)perylene	310	Ambient Values		
Benzo(k)fluoranthene	258	Ambient Values		
Biphenyl	12.9	Ambient Values		
Chrysene	289	Ambient Values	2,800	ER-M
Dibenz(a,h)anthracene	32.7	Ambient Values	260	ER-M
Fluoranthene	514	Ambient Values	5,100	ER-M
Fluorene	25.3	Ambient Values	540	ER-M
Indeno(1,2,3-c,d)pyrene	382	Ambient Values		
Naphthalene	55.8	Ambient Values	2,100	ER-M
Perylene	145	Ambient Values		
Phenanthrene	237	Ambient Values	1,500	ER-M
Pyrene	665	Ambient Values	2,600	ER-M

Emergent Marsh Vegetation and Open Water Area – Soil Cover Specifications

The soil specification formulated for the emergent marsh and open water area of the wetland is suitable for the establishment and productivity of emergent marsh vegetation and benthic invertebrates. All wetland cover soil placed in the primary open water area (below 243-feet NGVD) within the main pond shall meet both the RWQCB guidelines for wetland cover soil and the following soil cover specifications. Ideal and maximum acceptable ranges for soil texture, organic matter content, salinity, permeability, and compaction are provided below. The particle diameter classes are from the U.S. Department of Agriculture (USDA) classification system.

Wetland Soil Cover Specifications – Emergent Marsh Vegetation and Open Water Areas

Constituent	Ideal Range (% , dry weight)		Maximum Acceptable Range (% , dry weight)	
	Min.	Max.	Min.	Max.
Clay (0 – 0.002 mm) [1]	28	60	10	65
Silt (0.002 – 0.05 mm) [1]	15	70	0	70
Sand (0.05-2.0 mm) [1]	0	40	0	60
Gravel (2 – 12 mm) [2]	0	5	0	10
Rock (1/2 – 3 inch diameter)	0	2	0	5
Organic matter	3	8	1.5	8
Salinity (ppt)	0	1	0	3
Permeability (ft/day)	0.05	0.23	0.02	0.34
Compaction (% maximum density)	80	85	80	90

[1] Percent of sample passing through a 2 mm screen (dry weight basis).

[2] Percent of sample passing through a 12 mm screen (dry weight basis).

The ideal soils for emergent marsh vegetation and benthic invertebrates are classified as clay, silty clay, clay loam, or silty clay loam per the USDA system. Sandy clay loam, silt loam and loam textures could also be acceptable for emergent marsh, but are not ideal. If the maximum range for organic matter cannot be met by available soil sources, the percent organic matter can be increased through the addition of composted organic matter (C:N < 16:1).

If two or more soil sources are required in order to meet both the RWQCB guidelines for wetland cover soil and the soil cover specifications, the soils should be segregated based on permeability. The most permeable soil should be placed in the lower elevations of the wetland, and the least permeable soil should be placed in the upper elevations of the wetland. The overall permeability for all cover soils placed within the ponded area of the wetland (computed as a weighted average) should fall within the ideal range of 0.05 to 0.23 ft/day, and ideally, be as close as practical to a target rate 0.11 ft/day.

Riparian Vegetation Area – Soil Cover Specifications

The proposed soil cover specifications for areas planted with riparian vegetation were set primarily to support the establishment and productivity of riparian vegetation. All cover soil placed in the areas planted with riparian vegetation (above 243-feet NGVD) within the main pond shall meet both the RWQCB guidelines for wetland cover soil and the following soil cover specifications. Ideal and maximum acceptable ranges for soil texture, organic matter content, salinity, permeability, and compaction to support riparian vegetation are provided below. The particle diameter classes are from the U.S. Department of Agriculture (USDA) classification system.

Wetland Soil Cover Specifications – Riparian

	Ideal Range (% , dry weight)		Maximum Acceptable Range (% , dry weight)	
Constituent	Min.	Max.	Min.	Max.
Clay (0 – 0.002 mm) [1]	15	28	8	28
Silt (0.002 – 0.05 mm) [1]	25	40	20	60
Sand (0.05-2.0 mm) [1]	30	55	30	70
Gravel (2 – 12 mm) [2]	0	15	0	25
Rock (1/2 – 3 inch diameter)	0	10	0	20
Organic matter	3	8	1.5	8
Salinity (ppt)	0	1	0	1
Permeability (ft/day)	0.2	1.0	0.1	1.5
Compaction (% maximum density)	80	85	80	90

[1] Percent of sample passing through a 2 mm screen (dry weight basis).

[2] Percent of sample passing through a 12 mm screen (dry weight basis).

The acceptable soils to support riparian vegetation at the proposed mitigation site are classified as sandy clay loam, sandy loam, loam, and silt loam per the USDA system. The percent organic matter can be increased through the addition of composted organic matter (C:N < 16:1) if the minimum range cannot be met by potential soil sources.

Infiltration Pools – Soil Cover Specifications

The proposed soil cover specifications for the infiltration pools were primarily formulated to maintain percolation rates in the infiltration pools over the long-term. All cover soil placed at the base of the infiltration pools shall meet both the RWQCB guidelines for wetland cover soil and the following soil cover specifications.

Wetland Soil Cover Specifications – Infiltration Pools

Constituent	Ideal Range (% , dry weight)		Maximum Acceptable Range (% , dry weight)	
	Min.	Max.	Min.	Max.
Clay (0 – 0.002 mm) [1]	0	5	0	10
Silt (0.002 – 0.05 mm) [1]	5	10	0	20
Sand (0.05-2.0 mm) [1]	40	60	40	80
Gravel (2 – 12 mm) [2]	0	25	0	40
Rock (1/2 – 3 inch diameter)	0	15	0	25
Organic matter	3	8	1.5	8
Salinity (ppt)	0	1	0	1
Permeability (ft/day)	2	5	2	10
Compaction (% maximum density)	80	85	80	90

[1] Percent of sample passing through a 2 mm screen (dry weight basis).

[2] Percent of sample passing through a 12 mm screen (dry weight basis).

The acceptable soils to support long-term percolation in the infiltration pools at the proposed mitigation site are classified as sandy gravels and gravelly sands per the USDA system. The percent organic matter can be increased through the addition of composted organic matter (C:N < 16:1) if the minimum range cannot be met by potential soil sources.

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MEMORANDUM

DATE: March 27, 2002

TO: Files

FROM: Ann Borgonovo and Mark Lindley

RE: Los Capitancillos Freshwater Wetland Mitigation Project
Preliminary Estimate of Probable Construction Costs
PWA Ref. #: 1426

Preliminary estimates of construction costs were prepared to assist in the evaluation of the design alternatives selected for the planning study. The estimate of probable costs for Alternatives 1, 2 and 3 are presented in Tables 1, 2 and 3, respectively. For Alternative 1, the large near perennial wetland, the estimate of probable cost is $3,180,000. The estimate of probable cost for Alternative 2, the smaller near perennial wetland is $2,600,000. For Alternative 3, the seasonal wetland, the estimate of probable cost is $1,960,000.

It is difficult to estimate construction costs at this early stage of the design process. To assist with cost estimating, several assumptions were made regarding the final design, as indicated in the table footnotes. In addition, a 20% contingency was added to construction costs to cover design elements not completely detailed at this stage of the project. Cost estimates are based on estimates from suppliers, costs from similar projects and engineering judgment. The preliminary cost and quantity estimates will be refined in subsequent phases of the project, as the detailed design is developed.

The preliminary estimates for excavation and fill volume and other quantities were developed for Alternative 1, the large near-perennial wetland, which is presented in detail in Chapter 5 and the attached Preliminary Plans. In developing preliminary estimates for Alternatives 2 and 3, the excavation volumes were estimated by scaling down from the detailed estimates provided for Alternative 1 using engineering judgment.

Attachments:

Table 1:	Estimate of Probable Cost – Design Alternative 1 – Large, Near-Perennial Wetland
Table 2:	Estimate of Probable Cost – Design Alternative 2 – Smaller, Near-Perennial Wetland
Table 3:	Estimate of Probable Cost – Design Alternative 3 – Seasonal Wetland

Table 1
Los Capitancillos Freshwater Wetland Mitigation Project
Preliminary Opinion of Probable Construction Cost, March 2002
Design Alternaitve 1 - Large, Near-Perennial Wetland

Description	Quantity	Units	Cost/Unit	Cost
GENERAL				
Mobilization/Demobilizaton (10%)	1	lump sum	$ 241,000	$ 241,000
Dewatering	1	lump sum	$ 25,000	$ 25,000
Dust Control/Erosion Control	1	lump sum	$ 25,000	$ 25,000
WETLAND CONSTRUCTION				
Clearing and Grubbing	11	acres	$ 4,000	$ 44,000
Excavation	33000	cubic yds	$ 6	$ 198,000
Soil Sample Analysis	1	lump sum	$ 5,000	$ 3,000
On-site Fill Placement	9000	cubic yds	$ 6	$ 54,000
Offsite Transportation	24000	cubic yds	$ 14	$ 334,000
Offsite Disposal[1]	24000	cubic yds	$ 36	$ 864,000
Imported Cover Soil - Wetland	6200	cubic yds	$ 35	$ 217,000
Imported Cover Soil - Riparian Areas	1750	cubic yds	$ 35	$ 61,250
INLET WORKS				
Inlet Structure[2]	1	lump sum	$ 135,700	$ 135,700
Inlet Channel - Rock Step Pools[3]	5	each	$ 7,500	$ 37,500
OUTLET WORKS				
Emergency Spillway	1	lump sum	$ 35,600	$ 35,600
Percolation System	1	lump sum	$ 46,200	$ 46,200
Outlet Structure[4]	1	lump sum	$ 26,000	$ 26,000
Outlet Channel - Cobbles	150	cubic yds	$ 50	$ 7,500
Outlet Channel - Gravel	150	cubic yds	$ 40	$ 6,000
Outlet Channel - Sand	650	cubic yds	$ 35	$ 22,750
Outlet Channel - Grade Control Structures[5]	8	each	$ 3,000	$ 24,000
PUBLIC ACCESS				
Observation Points with Interpretive Signs	2	each	$ 7,500	$ 15,000
Path, 4' wide	500	sq yds	$ 5	$ 2,500
Vehicle Access, 10' wide	1600	sq yds	$ 10	$ 16,000
Pedestrian Access Gate with Signage	1	each	$ 4,000	$ 4,000
Dog Fence, 3' high	2150	ft	$ 7	$ 15,100
PLANTING				
Large Woody Debris Removal	3	tree	$ 2,500	$ 7,500
Herbicide Treatment (1.1 acres)	1	lump sum	$ 2,500	$ 2,500
Emergent Marsh	2611	plant	$ 4	$ 10,440
Wetland Ecotone	408	plant	$ 4	$ 1,630
Riparian Trees	201	cutting	$ 40	$ 8,040
Riparian Shrubs	347	basin	$ 45	$ 15,620
Outflow Swale Plants and Cuttings				$ 3,340
Irrigation System	633	basin	$ 79	$ 50,010
Pneumatic Mulch	1.1	acre	$ 16,110	$ 17,720
Hydroseeding	6	acre	$ 3,000	$ 18,000
Maintenance[6]				$ 51,900
SUB-TOTAL				**$ 2,646,800**
Contingency (20%)				$ 529,000
TOTAL				**$ 3,180,000**

---

[1] Assuming Class II offiste disposal at Altamont Landfill

[2] Inlet structure includes pressure-reducing valve vault, controls, piping to/from vault, and related hardware (RBF, March 2002)

[3] Inlet pools approximately 20' x 20' consisting of cobbles, 200 to 500 lb stone, and 1 to 2 ton stone crests

[4] Outlet structure includes weir gate, concrete headwalls, trash racks, discharge pipe, and related hardware (RBF, March 2002)

[5] Grade control structures approximately 2' wide x 2' deep x 37' long, and consist of 200 lb stone

[6] General plant maitenance includes irrigation, weed control, dead plant replacement, and swallow/bat box cleaning for 3 years (HTH, March 2002)

Table 2
Los Capitancillos Freshwater Wetland Mitigation Project
Preliminary Opinion of Probable Construction Cost, March 2002
Design Alternaitve 2 - Smaller, Near-Perennial Wetland

Description	Quantity	Units	Cost/Unit	Cost
GENERAL				
Mobilization/Demobilizaton (10%)	1	lump sum	$ 197,000	$ 197,000
Dewatering	1	lump sum	$ 25,000	$ 25,000
Dust Control/Erosion Control	1	lump sum	$ 25,000	$ 25,000
WETLAND CONSTRUCTION				
Clearing and Grubbing	11	acres	$ 4,000	$ 44,000
Excavation	26700	cubic yds	$ 6	$ 160,200
Soil Sample Analysis	1	lump sum	$ 4,000	$ 3,000
On-site Fill Placement	9000	cubic yds	$ 6	$ 54,000
Offsite Transportation	17700	cubic yds	$ 14	$ 246,000
Offsite Disposal[1]	17700	cubic yds	$ 36	$ 637,200
Imported Cover Soil - Wetland	5020	cubic yds	$ 35	$ 175,700
Imported Cover Soil - Riparian Areas	1420	cubic yds	$ 35	$ 49,700
INLET WORKS				
Inlet Structure[2]	1	lump sum	$ 135,700	$ 135,700
Inlet Channel - Rock Step Pools[3]	5	each	$ 7,500	$ 37,500
OUTLET WORKS				
Emergency Spillway	1	lump sum	$ 35,600	$ 35,600
Percolation System	1	lump sum	$ 46,200	$ 46,200
Outlet Structure[4]	1	lump sum	$ 26,000	$ 26,000
Outlet Channel - Cobbles	150	cubic yds	$ 50	$ 7,500
Outlet Channel - Gravel	150	cubic yds	$ 40	$ 6,000
Outlet Channel - Sand	650	cubic yds	$ 35	$ 22,750
Outlet Channel - Grade Control Structures[5]	8	each	$ 3,000	$ 24,000
PUBLIC ACCESS				
Observation Points with Interpretive Signs	2	each	$ 7,500	$ 15,000
Path, 4' wide	500	sq yds	$ 5	$ 2,500
Vehicle Access, 10' wide	1600	sq yds	$ 10	$ 16,000
Pedestrian Access Gate with Signage	1	each	$ 4,000	$ 4,000
Dog Fence, 3' high	2150	ft	$ 7	$ 15,100
PLANTING				
Large Woody Debris Removal	3	tree	$ 2,500	$ 7,500
Herbicide Treatment (1.1 acres)	1	lump sum	$ 2,500	$ 2,500
Emergent Marsh	2110	plant	$ 4	$ 8,440
Wetland Ecotone	330	plant	$ 4	$ 1,320
Riparian Trees	160	cutting	$ 40	$ 6,400
Riparian Shrubs	280	basin	$ 45	$ 12,600
Outflow Swale Plants and Cuttings				$ 2,710
Irrigation System	510	basin	$ 79	$ 40,290
Pneumatic Mulch	0.9	acre	$ 16,110	$ 14,500
Hydroseeding	4.9	acre	$ 3,000	$ 14,700
Maintenance[6]				$ 42,280
SUB-TOTAL				**$ 2,163,890**
Contingency (20%)				$ 433,000
TOTAL				**$ 2,600,000**

[1] Assuming Class II offiste disposal at Altamont Landfill

[2] Inlet structure includes pressure-reducing valve vault, controls, piping to/from vault, and related hardware (RBF, March 2002)

[3] Inlet pools approximately 20' x 20' consisting of cobbles, 200 to 500 lb stone, and 1 to 2 ton stone crests

[4] Outlet structure includes weir gate, concrete headwalls, trash racks, discharge pipe, and related hardware (RBF, March 2002)

[5] Grade control structures approximately 2' wide x 2' deep x 37' long, and consist of 200 lb stone

[6] General plant maitenance includes irrigation, weed control, dead plant replacement, and swallow/bat box cleaning for 3 years (HTH, March 2002)

Table 3
Los Capitancillos Freshwater Wetland Mitigation Project
Preliminary Opinion of Probable Construction Cost, March 2002
Design Alternaitve 3 - Seasonal Wetland

Description	Quantity	Units	Cost/Unit	Cost
GENERAL				
Mobilization/Demobilizaton (10%)	1	lump sum	$ 148,000	$ 148,000
Dewatering	1	lump sum	$ 25,000	$ 25,000
Dust Control/Erosion Control	1	lump sum	$ 25,000	$ 25,000
WETLAND CONSTRUCTION				
Clearing and Grubbing	11	acres	$ 4,000	$ 44,000
Excavation	16500	cubic yds	$ 6	$ 99,000
Soil Sample Analysis	1	lump sum	$ 3,000	$ 3,000
On-site Fill Placement	9000	cubic yds	$ 6	$ 54,000
Offsite Transportation	7500	cubic yds	$ 14	$ 104,000
Offsite Disposal[1]	7500	cubic yds	$ 36	$ 270,000
Imported Cover Soil - Wetland	6200	cubic yds	$ 35	$ 217,000
Imported Cover Soil - Riparian Areas	1750	cubic yds	$ 35	$ 61,250
INLET WORKS				
Inlet Structure[2]	1	lump sum	$ 135,700	$ 135,700
Inlet Channel - Rock Step Pools[3]	5	each	$ 7,500	$ 37,500
OUTLET WORKS				
Emergency Spillway	1	lump sum	$ 35,600	$ 35,600
Percolation System	1	lump sum	$ 46,200	$ 46,200
Outlet Structure[4]	1	lump sum	$ 26,000	$ 26,000
Outlet Channel - Cobbles	150	cubic yds	$ 50	$ 7,500
Outlet Channel - Gravel	150	cubic yds	$ 40	$ 6,000
Outlet Channel - Sand	650	cubic yds	$ 35	$ 22,750
Outlet Channel - Grade Control Structures[5]	8	each	$ 3,000	$ 24,000
PUBLIC ACCESS				
Observation Points with Interpretive Signs	2	each	$ 7,500	$ 15,000
Path, 4' wide	500	sq yds	$ 5	$ 2,500
Vehicle Access, 10' wide	1600	sq yds	$ 10	$ 16,000
Pedestrian Access Gate with Signage	1	each	$ 4,000	$ 4,000
Dog Fence, 3' high	2150	ft	$ 7	$ 15,100
PLANTING				
Large Woody Debris Removal	3	tree	$ 2,500	$ 7,500
Herbicide Treatment (1.1 acres)	1	lump sum	$ 2,500	$ 2,500
Emergent Marsh	2611	plant	$ 4	$ 10,440
Wetland Ecotone	408	plant	$ 4	$ 1,630
Riparian Trees	201	cutting	$ 40	$ 8,040
Riparian Shrubs	347	basin	$ 45	$ 15,620
Outflow Swale Plants and Cuttings				$ 3,340
Irrigation System	633	basin	$ 79	$ 50,010
Pneumatic Mulch	1.1	acre	$ 16,110	$ 17,720
Hydroseeding	6	acre	$ 3,000	$ 18,000
Maintenance[6]				$ 51,900
SUB-TOTAL				**$ 1,630,800**
Contingency (20%)				$ 326,000
TOTAL				**$ 1,960,000**

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[1] Assuming Class II offiste disposal at Altamont Landfill

[2] Inlet structure includes pressure-reducing valve vault, controls, piping to/from vault, and related hardware (RBF, March 2002)

[3] Inlet pools approximately 20' x 20' consisting of cobbles, 200 to 500 lb stone, and 1 to 2 ton stone crests

[4] Outlet structure includes weir gate, concrete headwalls, trash racks, discharge pipe, and related hardware (RBF, March 2002)

[5] Grade control structures approximately 2' wide x 2' deep x 37' long, and consist of 200 lb stone

[6] General plant maitenance includes irrigation, weed control, dead plant replacement, and swallow/bat box cleaning for 3 years (HTH, March 2002)

Appendix H

Wave Analysis

PWA
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MEMORANDUM

DATE: March 27, 2002

TO: Files

FROM: Carmela Chandrasekera

RE: # 1426, Los Capitancillos Freshwater Wetland Mitigation Project
Wind Wave Calculations

Introduction

Wind wave hind-casting follows the methods outlined in the Shore Protection Manual (SPM) (USACE, 1984). Input to the calculations consist of the fetch length, water depth and the wind data. The calculations were directed at obtaining the maximum average waves generated at the proposed freshwater wetland. The maximum fetch orientation is approximately in the NE-SW direction. The fetch distance in this direction is approximately 640 feet. The maximum water depths of the wetland are approximately 6 feet under operational conditions and 7 feet under extreme conditions. The average water depth of the wetland is approximately 2.85 feet. Monthly average wind data were available at San Jose (Station 69) from the California Irrigation Management Information System, Department of Water Resources (CIMIS web site) from June 1987 to August 2001. The maximum of the monthly average was found to be 5.6 mph. This wind speed is probably obtained by averaging wind speed measurements over 5 minutes to an hour and converts to a wind speed between 7.5 – 10 mph, 1-second wind gust. Since maximum wind data were not available, it was decided to hind cast waves over a range of wind speeds up to 20 mph gust.

Wind Wave Generation

The wind speed adjustments were made first as per SPM. The wind measurement at CIMIS gage at 2 m. elevation was converted to a standard 10 m elevation wind speed. In addition a stability adjustment was made for a series of gust speeds (5.6 mph – 20 mph). Wind speed-duration curves were generated for each gust speed considered (as per SPM figure 3-13). Accordingly, as the duration of the wind increases the strength of the wind decreases. The wind speed-duration input is required in the hind-casting process. In addition, fetch length (640 ft) and depth (2.85 ft and 7 ft) were input. The resulting wave heights and

The existing "open meadow" sub-basin is the Los Capitancillos project site in its existing undeveloped state. For both the existing and developed conditions, the "housing" sub-basin is the existing residential area that funnels overland flow to a drain pipe just north of the Los Capitancillos site and into Guadalupe Creek; the housing sub-basin is located south of the PG&E easement, west and north of Coleman Road, and east of Guadalupe Creek. The "pond" sub-basin is the 3-acre pond proposed for development in the existing open meadow. The "riparian and upland grassland" area is the remainder of the developed condition open meadow area, which would surround the pond after the pond is built. Sub-basin characteristics are shown in Table 1.

Precipitation

The Return Period-Duration-Specific Regional Equation (Wang et al., 1998) was used to estimate precipitation depth and rainfall intensity for the chosen design storms, as follows:

$$P_{T,D} = A_{T,D} + B_{T,D}MAP$$

$$I_{T,D} = P_{T,D} / D$$

where $P_{T,D}$ is the precipitation for a storm with return period T and duration D, $A_{T,D}$ and $B_{T,D}$ are coefficients determined by Wang et al. (1998) specific to storm return period and duration, MAP is mean annual precipitation, $I_{T,D}$ is rainfall intensity for a particular design storm, and D is storm duration. The MAP for our site was estimated at 20 inches using Santa Clara County historic precipitation information (Figure 1). Precipitation for the chosen design storms is shown in Table 2.

Rainfall Runoff Peak Flow

The rational method was used to estimate peak flow, as follows:

$$Q = CIA$$

where Q is peak flow, C is the rational method runoff coefficient (see Table 1), I is rainfall intensity (discussed earlier), and A is sub-basin area (see Table 1) (Chow et al., 1988).

It was assumed that the current drainage structures for the upstream housing area can handle storms equal to or less than those with a 25-year return period; therefore, the housing sub-basin is only factored into our analyses for 50- and 100-year events. In order to estimate peak flow from the upstream housing sub-basin that enters the project site for the 50- and 100-year events, the peak flow was calculated for the 25-year event and subtracted from the 50- and 100-year values.

Rainfall Runoff Volume

A portion of rainfall that falls on the site will be lost to interception, surface retention, and infiltration into the ground. Wang et al. (1998) recommend that these losses be calculated using the Soil Conservation Service (SCS) method:

$$P_e = (P - 0.2S)^2 / (P + 0.8S) \qquad P > 0.2S$$

$$S = (1000/CN) - 10$$

where P_e is excess rainfall or surface runoff, P is total storm rainfall, S is soil moisture holding capacity, and CN is the SCS runoff curve number dependent on soil type, land use, and existing moisture (see Table 1) (Wang et al., 1998). Runoff volume, V, for any given design storm was calculated as follows:

$$V = P_e \bullet \text{Sub-basin Area}$$

Runoff volume and peak flow estimations are shown in Table 3.

Wetland Stage-Storage and Stage-Discharge Relationships

The stage-storage relationship (Table 4) was taken from the current 30% Construction Plans.

To determine a stage-discharge relationship for the wetland, the adjustable outlet weir crest was set to an elevation of 243.5 feet, with the 45-degree V-notch extending down to 243 feet. The V-notch weir and rectangular weir equations (Haan et al., 1994) were used to compute total flow through the weir for a range of heads.

V-notch weir: $Q = 2.5\tan(\theta/2)H^{2.5}$

where Q is flow, θ is the angle of the V-notch, and H is head.

Rectangular weir: $Q = 3LH^{1.5}$

where Q is flow, L is the length of the weir, and H is head. Table 4 shows the relationship between flow over the weir and water surface elevation.

Wetland Outflow

The rainfall runoff volumes and corresponding peak flows were used to create hydrographs for the selected design storms. The hydrographs along with the wetland stage-storage and stage-discharge relationships (Table 4) were used to parameterize a HEC-1 model. The model was run for the selected design storms and with two initial wetland stages: 242.5 and 243 feet. HEC-1 model results are shown in Table 5. When the initial wetland stage was set at 242.5 feet, outflow was estimated to be zero for all but the 50- and 100-year events, and developed peak flow values are less than those of existing conditions for all but the 100-year, 24-hour event (existing = 1.14 cfs; developed = 1.37 cfs).

Attachments

Figure 1	Mean annual precipitation map
Table 1	Sub-basin Characteristics
Table 2	Precipitations
Table 3	Volumes and Peak Flows for Various Events
Table 4	Stage-Storage and Stage-Discharge Relationships
Table 5	HEC-1 Model Results

References

Chow, V.T., D.R. Maidment, and L.W. Mays. “Applied Hydrology.” McGraw Hill, New York, 1988.

Haan, C.T., B.J. Barfield, J.C. Hayes. “Design Hydrology and Sedimentology for Small Catchments.” Academic Press, San Diego, 1994.

Santa Clara Valley Water District. Mean annual precipitation map for Santa Clara County. Transmittal to PWA, July 2001.

Wang, J.C., W. Chang, T.L. Marks, and G.Q. Tabois III. “Santa Clara Valley Water District Water Resources Management Group Hydrology and Geology Unit: Draft Hydrology Procedures.” Santa Clara Valley Water District, December 1998.

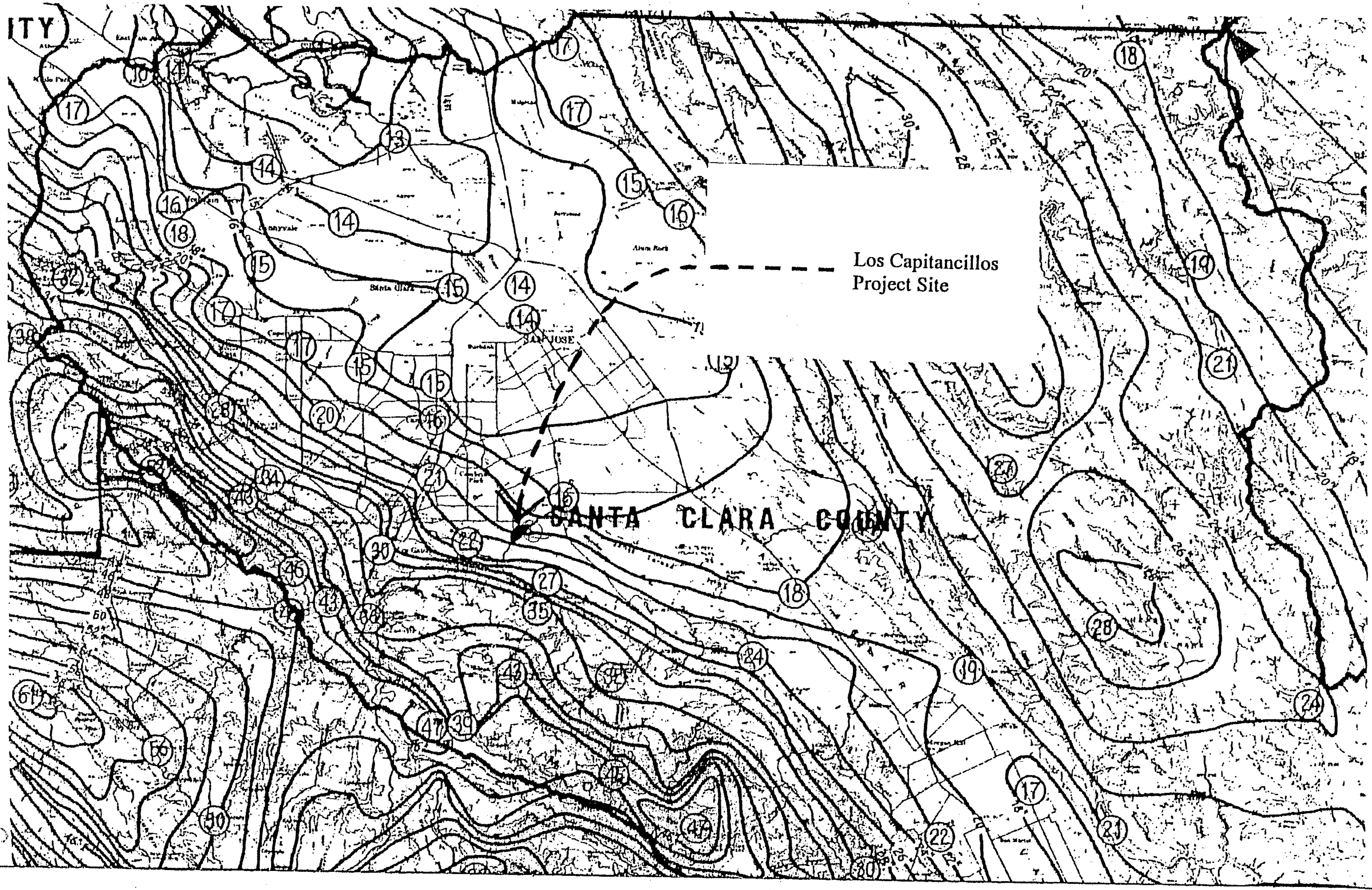

Figure 1. Mean annual precipitation map (SCVWD, 2001)

Table 1
Los Capitancillos Freshwater Wetland Mitigation Project
Sub-basin Characteristics

	Area	SCS		Rational
Sub-basin	**ac**	**CN**	**S**	**Run-off C**
Existing Open Meadow	10.6	68	4.706	0.2
Pond	3.0	n/a	n/a	1.0
Riparian and Upland Grassland	7.7	70	4.286	0.2
Housing	46.0	70	4.286	0.3

Table 2
Los Capitancillos Freshwater Wetland Mitigation Project
Precipitation

Event				P	I
yr	hr	$A_{T,D}$	$B_{T,D}$	in	in/hr
2	6	0.4252	0.0457	1.34	0.22
	12	0.4094	0.0693	1.79	0.15
	24	0.3142	0.0963	2.24	0.09
5	6	0.5549	0.0609	1.77	0.30
	12	0.5622	0.0949	2.46	0.20
	24	0.4745	0.1361	3.20	0.13
10	6	0.6251	0.0707	2.04	0.34
	12	0.6416	0.1117	2.87	0.24
	24	0.5670	0.1626	3.82	0.16
25	6	0.6936	0.0832	2.36	0.39
	12	0.7259	0.1323	3.37	0.28
	24	0.6750	0.1955	4.58	0.19
50	6	0.7407	0.0921	2.58	0.43
	12	0.7800	0.1473	3.73	0.31
	24	0.7471	0.2197	5.14	0.21
100	6	0.7767	0.1011	2.80	0.47
	12	0.8219	0.1622	4.07	0.34
	24	0.8140	0.2434	5.68	0.24

Table 3
Los Capitancillos Freshwater Wetland Mitigation Project
Volumes and Peak Flows for Various Events

Event		Exsiting Conditions, no pond (currently draining to creek)			Developed, with pond (wetland inflow)			
yr	hr	Open	Housing	Total	Open (no pond)	Housing	Pond	Total
				Volume, acre-feet				
2	6	0.03	0.00	**0.03**	0.03	0.00	0.33	**0.36**
	12	0.12	0.00	**0.12**	0.11	0.00	0.44	**0.55**
	24	0.25	0.00	**0.25**	0.22	0.00	0.55	**0.77**
5	6	0.11	0.00	**0.11**	0.10	0.00	0.44	**0.54**
	12	0.33	0.00	**0.33**	0.28	0.00	0.60	**0.88**
	24	0.65	0.00	**0.65**	0.53	0.00	0.79	**1.31**
10	6	0.18	0.00	**0.18**	0.16	0.00	0.50	**0.67**
	12	0.50	0.00	**0.50**	0.41	0.00	0.71	**1.12**
	24	0.97	0.00	**0.97**	0.78	0.00	0.94	**1.71**
25	6	0.29	0.00	**0.29**	0.25	0.00	0.58	**0.83**
	12	0.73	0.00	**0.73**	0.60	0.00	0.83	**1.43**
	24	1.41	0.00	**1.41**	1.11	0.00	1.13	**2.24**
50	6	0.38	0.17	**0.54**	0.32	0.17	0.63	**1.12**
	12	0.92	0.42	**1.34**	0.74	0.42	0.92	**2.07**
	24	1.76	0.89	**2.64**	1.37	0.89	1.26	**3.52**
100	6	0.47	0.36	**0.83**	0.39	0.36	0.69	**1.44**
	12	1.11	0.90	**2.00**	0.88	0.90	1.00	**2.78**
	24	2.11	1.89	**4.00**	1.64	1.89	1.40	**4.93**
				Peak Flow, cubic feet per second				
2	6	0.48	0.00	**0.48**	0.35	0.00	0.66	**1.01**
	12	0.32	0.00	**0.32**	0.23	0.00	0.44	**0.68**
	24	0.20	0.00	**0.20**	0.14	0.00	0.28	**0.42**
5	6	0.63	0.00	**0.63**	0.46	0.00	0.88	**1.34**
	12	0.44	0.00	**0.44**	0.32	0.00	0.61	**0.93**
	24	0.29	0.00	**0.29**	0.21	0.00	0.40	**0.60**
10	6	0.73	0.00	**0.73**	0.53	0.00	1.01	**1.54**
	12	0.51	0.00	**0.51**	0.37	0.00	0.71	**1.08**
	24	0.34	0.00	**0.34**	0.25	0.00	0.47	**0.72**
25	6	0.84	0.00	**0.84**	0.61	0.00	1.17	**1.78**
	12	0.60	0.00	**0.60**	0.44	0.00	0.84	**1.27**
	24	0.41	0.00	**0.41**	0.30	0.00	0.57	**0.86**
50	6	0.92	0.52	**1.45**	0.67	0.52	1.28	**2.47**
	12	0.67	0.41	**1.08**	0.48	0.41	0.92	**1.82**
	24	0.46	0.32	**0.78**	0.33	0.32	0.64	**1.29**
100	6	1.00	1.02	**2.02**	0.72	1.02	1.39	**3.13**
	12	0.73	0.80	**1.53**	0.53	0.80	1.01	**2.34**
	24	0.51	0.64	**1.14**	0.37	0.64	0.70	**1.71**

Table 4
Los Capitancillos Freshwater Wetland Mitigation Project
Stage-Storage and Stage-Discharge Relationships

Stage ft	Storage ac-ft
237.0	0.00
238.0	0.14
239.0	0.55
240.0	1.46
241.0	3.19
242.0	5.50
243.0	8.33
244.0	11.73

Based on 30% construction plans

Stage ft	Discharge cfs
237.0	0.00
238.0	0.00
239.0	0.00
240.0	0.00
241.0	0.00
242.0	0.00
243.0	0.00
243.1	0.00
243.2	0.02
243.3	0.05
243.4	0.10
243.5	0.18
243.6	0.47
243.7	0.99
243.8	1.66
243.9	2.46
244.0	3.37

Weir crest set at 243.5 ft NGVD

Table 5
Los Capitancillos Freshwater Wetland Mitigation Project
HEC-1 Model Results
Peak Stage and Peak Outflow for Selected Design Storms

Event		Existing	Wetland Inflow		Initial Stage = 242.5 ft		Initial Stage = 243 ft	
		Peak Q	Volume	Peak Q	Peak Stage	Peak Q (outflow)	Peak Stage	Peak Q (outflow)
yr	hr	cfs	ac-ft	cfs	ft	cfs	ft	cfs
2	6	0.48	0.36	1.01	242.62	0.00	243.12	0.01
	12	0.32	0.55	0.68	242.69	0.00	243.18	0.02
	24	0.20	0.77	0.42	242.76	0.00	243.24	0.03
5	6	0.63	0.54	1.34	242.69	0.00	243.18	0.02
	12	0.44	0.88	0.93	242.80	0.00	243.28	0.04
	24	0.29	1.31	0.60	242.94	0.00	243.39	0.10
10	6	0.73	0.67	1.54	242.73	0.00	243.21	0.02
	12	0.51	1.12	1.08	242.88	0.00	243.34	0.08
	24	0.34	1.71	0.72	243.07	0.00	243.49	0.17
25	6	0.84	0.83	1.78	242.78	0.00	243.26	0.04
	12	0.60	1.43	1.27	242.98	0.00	243.43	0.13
	24	0.41	2.24	0.86	243.23	0.00	243.59	0.44
50	6	1.45	1.12	2.47	242.88	0.00	243.35	0.08
	12	1.08	2.07	1.82	243.18	0.02	243.59	0.45
	24	0.78	3.52	1.29	243.57	0.38	243.72	1.14
100	6	2.02	1.44	3.13	242.97	0.00	243.43	0.13
	12	1.53	2.78	2.34	243.39	0.10	243.73	1.18
	24	1.14	4.93	1.71	243.76	1.37	243.80	1.65

Appendix K

Drawdown Analysis

PWA
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MEMORANDUM

DATE: March 22, 2002

TO: Files

FROM: Setenay Bozkurt and Mark Lindley

RE: Los Capitancillos Freshwater Wetland Mitigation Project
Annual Drawdown Analysis
PWA Ref. #: 1426

PWA performed an analysis of the planned annual drawdown period for the Los Capitancillos Wetland. The wetland will be flooded to the lower edge of the riparian fringe (243-feet NGVD) from November through August. The annual drawdown period will begin in the beginning of September when pipeline inflows will be stopped and water levels will recede gradually via evaporation and percolation through the soil liner, outlet swale, and percolation network. For design purposes, this is assumed to occur over no more than a four-week period. After the drawdown is complete, the wetland will remain dry for the first two weeks of October before being refilled later in October.

The drawdown analysis was performed assuming average climatic conditions for the month of September. A percolation capacity of 0.15 cfs will allow the wetland to be drained in 28 days, and was therefore the minimum allowable total percolation rate to achieved the design drawdown schedule. The drawdown analysis used estimated short-term and long-term percolation rates for the soil liner specified in the 30% Construction Plans, and a conservative estimate for the outlet swale percolation capacity. The estimated soil liner percolation rates were 0.25 ft/day for the short-term, and 0.05 ft/day over the long- term (Percolation Analysis, March 2002). An in-situ permeability of 0.001 cm/s was utilized to estimate the outlet swale percolation capacity of 0.23 cfs (Percolation Analysis, March 2002). Both soil liner and outlet swale percolation rates are a function of the depth of water in the wetland, and decrease with decreasing water level. Therefore, the percolation rates were calculated as a function of the water level.

The results indicate that for the short-term estimate of soil liner percolation rate, the drawdown would be complete in 13 days; and for long-term soil liner percolation rate, the drawdown would be complete in 18 days. In both scenarios, the drawdown is completed utilizing only liner and outlet swale for percolation indicating that the percolation network included in the 30% Construction Plans may not be required except to further increase the factor of safety or as an alternate drainage system. With an estimated capacity of 0.69 cfs (Percolation Analysis, March 2002), the percolation network provides an additional level of redundancy and flexibility for draining the wetland during the annual drawdown.

Attachments:

Table 1:	Predicted Drawdown Analysis with Soil Liner Short Term Percolation Rate
Table 2:	Predicted Drawdown Analysis with Soil Liner Long Term Percolation Rate

Los Capitancillos Freshwater Wetland Mitigation Project
Predicted Drawdown Through Processes of Percolation & Evaporation

Months	WSE (ft NGVD)	Area (ac)	Volume (ac-ft)	Precipitation Rate (ft^3/day)	Evaporation Rate (ft^3/day)	Soil Liner Short Term Percolation Rate 0.25 ft/day (ft^3/day)	Outlet Swale Percolation Rate K = 0.001 cms (ft^3/day)	Delta Volume (ac-ft)
1-Sep	243.00	2.950	8.33	57	1,542	32,126	20,010	1.23
2-Sep	242.57	2.853	7.10	55	1,492	27,689	20,010	1.13
3-Sep	242.17	2.757	5.97	53	1,442	23,635	20,010	1.03
4-Sep	241.77	2.497	4.94	48	1,306	19,187	20,010	0.93
5-Sep	241.38	2.203	4.01	42	1,152	15,421	20,010	0.84
6-Sep	240.99	2.088	3.17	40	1,092	13,079	20,010	0.78
7-Sep	240.59	1.855	2.39	36	970	11,072	20,010	0.74
8-Sep	240.13	1.365	1.65	26	714	7,682	20,010	0.65
9-Sep	239.50	0.909	1.00	17	475	4,565	14,792	0.45
10-Sep	238.97	0.595	0.54	11	311	2,662	9,495	0.29
11-Sep	238.29	0.334	0.26	6	175	1,178	7,465	0.20
12-Sep	237.43	0.130	0.06	2	68	162	5,080	0.06
13-Sep	237.00	0.060	0.00					0.00
14-Sep	WETLAND DRAWDOWN COMPLETE							
15-Sep								
16-Sep								
17-Sep								
18-Sep								
19-Sep								
20-Sep								
21-Sep								
22-Sep								
23-Sep								
24-Sep								
25-Sep								
26-Sep								
27-Sep								
28-Sep								
29-Sep								
30-Sep								
TOTAL (ft3/day)				**394**	**10,738**	**158,458**	**196,914**	
TOTAL (ac-ft)				**0.0091**	**0.2465**	**3.64**	**4.52**	**8.33**

Los Capitancillos Freshwater Wetland Mitigation Project
Predicted Drawdown Through Processes of Percolation & Evaporation

Months	WSE (ft NGVD)	Area (ac)	Volume (ac-ft)	Precipitation Rate (ft^3/day)	Evaporation Rate (ft^3/day)	Soil Liner Long Term Percolation Rate 0.05 ft/day (ft^3/day)	Outlet Swale Percolation Rate K = 0.001 cms (ft^3/day)	Delta Volume (ac-ft)
1-Sep	243.00	2.950	8.33	57	1,542	6,425	20,010	0.64
2-Sep	242.77	2.900	7.69	56	1,516	5,950	20,010	0.63
3-Sep	242.55	2.848	7.06	55	1,489	5,483	20,010	0.62
4-Sep	242.33	2.796	6.44	54	1,462	5,030	20,010	0.61
5-Sep	242.12	2.745	5.83	53	1,435	4,604	20,010	0.60
6-Sep	241.90	2.620	5.24	50	1,370	4,131	20,010	0.58
7-Sep	241.65	2.387	4.65	46	1,248	3,546	20,010	0.57
8-Sep	241.41	2.212	4.08	42	1,157	3,093	20,010	0.56
9-Sep	241.16	2.139	3.53	41	1,118	2,786	20,010	0.55
10-Sep	240.90	2.033	2.98	39	1,063	2,506	20,010	0.54
11-Sep	240.62	1.872	2.44	36	979	2,226	20,010	0.53
12-Sep	240.30	1.566	1.91	30	819	1,794	20,010	0.52
13-Sep	239.92	1.164	1.39	22	609	1,263	19,198	0.48
14-Sep	239.40	0.848	0.91	16	443	831	13,746	0.34
15-Sep	239.01	0.612	0.56	12	320	549	9,573	0.24
16-Sep	238.44	0.392	0.32	8	205	290	7,888	0.19
17-Sep	237.93	0.212	0.13	4	111	118	6,307	0.13
18-Sep	237.00	0.060	0.00	1	31	33	7,888	0.00
19-Sep	WETLAND DRAWDOWN COMPLETE							
20-Sep								
21-Sep								
22-Sep								
23-Sep								
24-Sep								
25-Sep								
26-Sep								
27-Sep								
28-Sep								
29-Sep								
30-Sep								
TOTAL (ft3/day)				**622**	**16,918**	**50,659**	**304,724**	
TOTAL (ac-ft)				**0.0143**	**0.39**	**1.16**	**7.00**	**8.33**

Appendix L

Percolation Analysis

PWA
PHILIP WILLIAMS & ASSOCIATES
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MEMORANDUM

DATE: March 14, 2002

TO: Files

FROM: Mark Lindley
Associate

RE: Los Capitancillos Freshwater Wetland Mitigation Project
Percolation Analyses: Clean Soil Liner, Outlet Swale System, and Percolation Network

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Percolation rates have been estimated for the three main percolation features: the clean soil liner, outlet swale system, and the percolation network, included in the 30% Construction Plans for the Los Capitancillos Freshwater Wetland Mitigation Project. Percolation rates for each of the three main percolation features were estimated by applying Darcy's Law for a range of wetland water surface elevations with appropriate estimates of soil permeability, based on the limited information available at this stage of the project. Results of this analysis are presented on the attached tables.

Clean Soil Liner

Percolation through the clean soil liner was modeled with Darcy's Law as a constant head permeameter. The wetland was divided into slices with areas and average depths defined by the contours included in the grading plan. Percolation through each slice was computed for a range of soil liner permeabilities and totaled to estimate percolation rates for the main pond.

The soil liner included in the 30% design is 1-foot thick in deeper open water areas and 1.5-feet thick in shallow open water areas and areas were emergent marsh and riparian vegetation will be planted. The soil liner specifications require a predominantly silt soil with a permeability ideally between 0.11-ft/day and 0.23-feet/day and a maximum range of 0.05- to 0.34-ft/day. District experience operating the nearby Los Capitancillos Percolation Ponds indicates that, over time, permeability and, therefore, percolation rates decline due to the accumulation of fine soil particles and biomass. Therefore, over time, permeability in the constructed wetland is also expected to decline. Percolation rates for the wetland were estimated assuming the upper and lower limits of the ideal and maximum range of proposed soil liner permeability. A short-term, high percolation rate was also estimated based on District experience, and a long-term minimum percolation rate was estimated assuming that permeability would decline over time by an order of magnitude.

As the wetland water levels decline during the annual drawdown, percolation rates will also decline due to the decrease in head over the soil liner and the wetted area within the main pond. Percolation rates were estimated for a range of water depths within the wetland assuming the upper and lower limits of the ideal range of specified permeability and the estimated long-term permeability.

Outlet Swale System

The outlet swale system shown in the 30% Construction Plans was split into three separate sections: the percolation trench (connected to the main pond via a perforated pipe) in the outlet swale and each of the two infiltration pools. Percolation rates through each of the three elements were estimated for a range of water depths within the main wetland which determine the water level within the outlet swale system. Permeability of the in-situ soils was estimated in earlier geotechnical investigations to range between 0.01-cm/s and 200-cm/s (Parikh, 2001). As a conservative assumption in computing percolation rates in the outlet swale system, a permeability of 0.001 cm/s was utilized. The effective area of the percolation trench was estimated to be the wetted surface area. A hydraulic gradient of 1 foot/foot from the trench to the groundwater table was assumed.

Percolation Network

The percolation network shown in the 30% Construction Plans is comprised of two percolation trenches (connected to the main pond via perforated pipes) located under the riparian habitat surrounding the main pond. Percolation rates through the two percolation trenches were estimated in a similar manner to the outlet swale percolation trench. A permeability of 0.001 cm/s was utilized for the in-situ soils; the effective area of the percolation trench was estimated to be the wetted surface area; and a hydraulic gradient of 1 foot/foot was assumed from the trench to the groundwater table was assumed.

Attachments:

Tables 1 - 3:	Percolation through Clean Soil Liner in the Main Pond
Table 4:	Percolation Capacity of the Outlet Swale and Infiltration Pools
Table 5:	Percolation Capacity of the Percolation Network

Los Capitancillos Freshwater Wetland Mitigation Project
Percolation through Clean Soil Liner in Main Pond

Percolation Rate as a Function of Liner Permeability
Summary of Sliced Analysis Results

Liner Permeability cm/s	m/s	ft/day	Depth ft	Area ft^2	Influence ft	Percolation ac-ft/day	ft/day	Soil Liner Properties
1.6E-04	2E-06	0.45	6	128459	30	2.95	1.00	SCVWD "good" performance
1.2E-04	1E-06	0.34	6	128459	26	2.21	0.75	sandy-silt
7.9E-05	8E-07	0.23	6	128459	21	1.47	0.50	silty-sand
4.0E-05	4E-07	0.11	6	128459	15	0.74	0.25	SCVWD "poor" performance
1.6E-05	2E-07	0.05	6	128459	10	0.29	0.10	sand-silt-clay mix
7.9E-06	8E-08	0.02	6	128459	7	0.15	0.05	estimated long term permeability

Los Capitancillos Freshwater Wetland Mitigation Project
Percolation through Clean Soil Liner in Main Pond

Percolation Rate as a Function of Liner Permeability
Sliced Analysis

WSE	Contour	Area	Net Area	Head	Thickness	K		Percolation	
ft NGVD	ft NGVD	ft^2	ft^2	ft	ft	ft/day	ft^3/day	ac-ft/day	ft/day
SCVWD "good" performance									
243	243	128459	10309	0.5	1.5	0.45	1546		
243	242	118150	27087	1.5	1.5	0.45	12189		
243	241	91063	38401	2.5	1.5	0.45	28801		
243	240	52662	26327	3.5	1.5	0.45	27643		
243	239	26335	16655	4.5	1	0.45	33726		
243	238	9680	7124	5.5	1	0.45	17632		
243	237	2556	2556	6	1	0.45	6901		
Totals			**128459**			**0.45**	**128439**	**2.95**	**1.00**
sandy-silt									
243	243	128459	10309	0.5	1.5	0.34	1158		
243	242	118150	27087	1.5	1.5	0.337	9128		
243	241	91063	38401	2.5	1.5	0.337	21569		
243	240	52662	26327	3.5	1.5	0.337	20702		
243	239	26335	16655	4.5	1	0.337	25257		
243	238	9680	7124	5.5	1	0.337	13204		
243	237	2556	2556	6	1	0.337	5168		
Totals			**128459**			**0.337**	**96187**	**2.21**	**0.75**
silty-sand									
243	243	128459	10309	0.5	1.5	0.225	773		
243	242	118150	27087	1.5	1.5	0.225	6095		
243	241	91063	38401	2.5	1.5	0.225	14400		
243	240	52662	26327	3.5	1.5	0.225	13822		
243	239	26335	16655	4.5	1	0.225	16863		
243	238	9680	7124	5.5	1	0.225	8816		
243	237	2556	2556	6	1	0.225	3451		
Totals			**128459**			**0.225**	**64220**	**1.47**	**0.50**
SCVWD "poor" performance									
243	243	128459	10309	0.5	1.5	0.113	388		
243	242	118150	27087	1.5	1.5	0.113	3061		
243	241	91063	38401	2.5	1.5	0.113	7232		
243	240	52662	26327	3.5	1.5	0.113	6942		
243	239	26335	16655	4.5	1	0.113	8469		
243	238	9680	7124	5.5	1	0.113	4428		
243	237	2556	2556	6	1	0.113	1733		
Totals			**128459**			**0.113**	**32252**	**0.74**	**0.25**
sand-silt-clay mix									
243	243	128459	10309	0.5	1.5	0.045	155		
243	242	118150	27087	1.5	1.5	0.045	1219		
243	241	91063	38401	2.5	1.5	0.045	2880		
243	240	52662	26327	3.5	1.5	0.045	2764		
243	239	26335	16655	4.5	1	0.045	3373		
243	238	9680	7124	5.5	1	0.045	1763		
243	237	2556	2556	6	1	0.045	690		
Totals			**128459**			**0.045**	**12844**	**0.29**	**0.10**
estimated long term permeability									
243	243	128459	10309	0.5	1.5	0.0225	77		
243	242	118150	27087	1.5	1.5	0.0225	609		
243	241	91063	38401	2.5	1.5	0.0225	1440		
243	240	52662	26327	3.5	1.5	0.0225	1382		
243	239	26335	16655	4.5	1	0.0225	1686		
243	238	9680	7124	5.5	1	0.0225	882		
243	237	2556	2556	6	1	0.0225	345		
Totals			**128459**			**0.0225**	**6422**	**0.15**	**0.05**

Los Capitancillos Freshwater Wetland Mitigation Project
Percolation through Clean Soil Liner in Main Pond

Percolation Rate as a Function of Pond Stage and Liner Permeability
Summary of Sliced Analysis Results

Stage ft	Area ft^2	silty-sand K ft/day	silty-sand Percolation ac-ft/day	silty-sand Percolation ft/day	SCVWD "poor" performance K ft/day	SCVWD "poor" performance Percolation ac-ft/day	SCVWD "poor" performance Percolation ft/day	estimated long term permeability K ft/day	estimated long term permeability Percolation ac-ft/day	estimated long term permeability Percolation ft/day
243	128459	0.225	1.47	0.50	0.113	0.74	0.25	0.023	0.15	0.05
242	118150	0.225	1.00	0.37	0.113	0.50	0.19	0.023	0.10	0.04
241	91063	0.225	0.60	0.29	0.113	0.30	0.14	0.023	0.06	0.03
240	52662	0.225	0.31	0.25	0.113	0.15	0.13	0.023	0.03	0.03
239	26335	0.225	0.12	0.21	0.113	0.06	0.10	0.023	0.01	0.02
238	9680	0.225	0.03	0.14	0.113	0.02	0.07	0.023	0.00	0.01
237	2556	0.225	0.00	0.00	0.113	0.00	0.00	0.023	0.00	0.00

Los Capitancillos Freshwater Wetland Mitigation Project
Percolation Capacity of Outlet Swale and Infiltration Pools

Total Percolation Rate as a Function of Pond Stage

Pond Stage	Permeability			Percolation Capacity	
ft	cm/s	m/s	ft/day	ft^3/day	cfs
243	0.001	1E-05	2.85	20007	0.23
242	0.001	1E-05	2.85	20007	0.23
241	0.001	1E-05	2.85	20007	0.23
240	0.001	1E-05	2.85	20007	0.23
239	0.001	1E-05	2.85	9576	0.11
238	0.001	1E-05	2.85	6555	0.08
237	0.001	1E-05	2.85	4104	0.05

Percolation Rate of Outlet Swale Percoltion Trench as a Function of Pond Stage

Pond Stage	GW Level	Length	Perimeter	Area	Permeability			Percolation Capacity	
ft	ft	ft	ft	ft^2	cm/s	m/s	ft/day	ft^3/day	cfs
243	235	130	14	1820	0.001	1E-05	2.85	5187	0.06
242	235	130	14	1820	0.001	1E-05	2.85	5187	0.06
241	235	130	14	1820	0.001	1E-05	2.85	5187	0.06
240	235	130	14	1820	0.001	1E-05	2.85	5187	0.06
239	235	130	12	1560	0.001	1E-05	2.85	4446	0.05
238	235	130	10	1300	0.001	1E-05	2.85	3705	0.04
237	235	130	8	1040	0.001	1E-05	2.85	2964	0.03

Percolation Rate of Infiltration Pool #1 as a Function of Pond Stage

Pond Stage	GW Level	Length	Width	Area	Permeability			Percolation Capacity	
ft	ft	ft	ft	ft^2	cm/s	m/s	ft/day	ft^3/day	cfs
243	235	70	40	2800	0.001	1E-05	2.85	7980	0.09
242	235	70	40	2800	0.001	1E-05	2.85	7980	0.09
241	235	70	40	2800	0.001	1E-05	2.85	7980	0.09
240	235	70	40	2800	0.001	1E-05	2.85	7980	0.09
239	235	60	30	1800	0.001	1E-05	2.85	5130	0.06
238	235	50	20	1000	0.001	1E-05	2.85	2850	0.03
237	235	40	10	400	0.001	1E-05	2.85	1140	0.01

Percolation Rate of Infiltration Pool #2 as a Function of Pond Stage

Pond Stage	GW Level	Length	Width	Area	Permeability			Percolation Capacity	
ft	ft	ft	ft	ft^2	cm/s	m/s	ft/day	ft^3/day	cfs
243	235	60	40	2400	0.001	1E-05	2.85	6840	0.08
242	235	60	40	2400	0.001	1E-05	2.85	6840	0.08
241	235	60	40	2400	0.001	1E-05	2.85	6840	0.08
240	235	60	40	2400	0.001	1E-05	2.85	6840	0.08
239	235	50	30	1500	0.001	1E-05	2.85	0	0.00
238	235	40	20	800	0.001	1E-05	2.85	0	0.00
237	235	30	10	300	0.001	1E-05	2.85	0	0.00

Los Capitancillos Freshwater Wetland Mitigation Project
Percolation Capacity of Percolation Network

Pond Stage ft	GW Level ft	Length ft	Perimeter ft	Area ft^2	Permeability cm/s	Permeability m/s	Permeability ft/day	Percolation Capacity ft^3/day	Percolation Capacity cfs
243	235	1500	14	21000	0.001	1E-05	2.85	59850	0.69
242	235	1500	14	21000	0.001	1E-05	2.85	59850	0.69
241	235	1500	14	21000	0.001	1E-05	2.85	59850	0.69
240	235	1500	12	18000	0.001	1E-05	2.85	51300	0.59
239	235	1500	10	15000	0.001	1E-05	2.85	42750	0.49
238	235	1500	8	12000	0.001	1E-05	2.85	34200	0.40
237	235	1500	6	9000	0.001	1E-05	2.85	25650	0.30

Appendix M

Seepage Analysis

GEOTECHNICAL ENGINEERING REPORT
LOS CAPITANCILLOS FRESHWATER
WETLAND MITIGATION PROJECT
SANTA CLARA VALLEY WATER DISTRICT
SANTA CLARA COUNTY, CALIFORNIA

For

Philip Williams & Associates, Ltd.
770 Tamalpais Drive, Suite 401
Corte Madera, CA 94925

PARIKH CONSULTANTS, INC.
481 Valley Way, Milpitas, CA 95035
(408) 945-1011

October, 2001

Job No. 99154.10

PARIKH CONSULTANTS, INC.

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- *Geotechnical*
- *Environmental*
- *Materials Testing*
- *Construction Inspection*

Philip Williams & Associates
Consultants in Hydrology
770 Tamalpais Drive, Suite 401
Corte Madera, CA 94925

October 16, 2001
Job No. 99154.10

Attn: Mark Lindley

Sub: Los Capitancillos Freshwater Wetland Mitigation Project

Dear Mr. Lindley:

This letter presents the response to your memorandum, dated September 25, 2001. Based on this memorandum, PWA is requesting Parikh Consultants, Inc., to prepare a brief report that provides geotechnical engineering analyses and recommendations that will be included in the Engineer's report. The following issues were requested:

1. Wetland Soil Cover Specifications.
2. Stability, Bulking and Compaction.
3. Erosion Control.
4. Seepage Analysis.

Per your request, a separate letter will follow, which will present the groundwater monitoring data, at piezometers B-1 to B-3 from May 2000 to August 2001.

We have had several discussions with your office in regards to these elements of work. We believe that there should be a clarification as to the intent of the soil cover (liner) from an engineering perspective and vegetation perspective. As we understand, the intent of the liner is to allow certain level of percolation, maintain overall slope stability and facilitate vegetation growth. However, in order to meet the engineering criteria the soil may need to be coarse-grained and compacted to a 90% to 95% relative compaction. This could meet the percolation and slope stability requirements, however it may not be favorable for growing vegetation. If a fine-grained material is used and is compacted to relatively low compaction, it may not be stable enough or permeable enough to meet the percolation criteria or keep the pond liner stable. In order to meet both these criteria it is suggested to design the liner to meet the engineering criteria and overlay with the appropriate "growing medium" for the vegetation. The reduction in percolation due to the "growing medium" would have to be accounted for in the overall calculations. Based on this understanding we have provided discussions and recommendations in this report.

It should be recognized that, once the pond is in use, it will tend to collect fine-grained soil over a period of time. This will ultimately "choke" the liner unless routine maintenance is performed to rejuvenate the liner. This "choking" process will accelerate even more with the wetland mitigation program and vegetation since the plant material will disintegrate and add to the impermeability of the liner. Additional concepts such as installation of shallow standpipes (which penetrate through the liner into native soil) may be explored. This could allow percolation through the native soil while protecting the "openings" from sediments. This concept will depend on the ultimate goal or program for the pond.

Wetland Soil Cover Specifications

As discussed above, the design of the proposed wetland soil cover is intended to satisfy different but interrelated requirements:

(a) Hydrologic objectives: Per the information provided by PWA, in order to balance inflows with losses, the target percolation rate of the cover should be 0.2 to 0.3 ft/day (1.4 to $2.1\text{X}10^{-4}$ ft/min).

(b) Vegetation establishment: The soil cover should support emergent wetland plant growth in the upper 12 inches at the tall emergent wetland areas and allow the colonization of the upper 4 inches of the sediment by feeding and burrowing species at the open water habitat areas. Design recommendations to meet these criteria are beyond our scope and expertise.

(c) Structural integrity: The soil cover should be properly compacted and have at least the minimum required thickness in order to be functional from an engineering perspective.

We believe that since the underlying on-site soil material is known to be highly permeable, the soil cover should be designed using a rather conservative approach. Consequently, we recommend that it would be more effective to construct the soil cover using a relatively coarse material (clayey sand or silty sand) properly compacted (90 to 95% Relative Compaction) rather than a finer material (e.g. silt, sandy clay loam) that would be moderately compacted ($\leq$85% Relative Compaction). Based on the available published literature and our experience, we believe that such a material (clayey sand or silty sand) compacted to 90-95% Relative Compaction per ASTM specifications should yield a percolation rate on the order of 10^{-4} to 10^{-5} ft/min, which is close to the target percolation rate. The minimum thickness for the compacted soil cover should be no less than 12 inches, in order to be more resistant against differential settlements and in order to minimize cracks.

As discussed earlier, this base soil cover may not meet the criteria for the establishment of the vegetation. For this purpose, we recommend that an additional layer of 6 to 12 inches of appropriate soil be placed and moderately compacted on top of the base soil cover in the riparian/tall emergent wetland areas. This layer should be sufficient to support the growth of the wetland plants, since the majority of the root biomass related to the target wetland species typically occurs in the upper 12 inches of soil. As per the open water habitat areas, the subsurface deposits feeding and burrowing species likely to colonize the site generally occur within the upper 4 inches of sediment. Consequently, we recommend a 4-inch thick layer of appropriate "non-engineered" soil to be placed on top of the base cover in order to satisfy this requirement. The nature of the soil in these proposed "growing media" should be determined based on vegetation and/or other criteria, which are beyond our scope of work.

Grade specifications regarding the grain size distribution of the proposed soil cover (base layer) are as follows:

Sieve Size	**Proposed Operating Range (Percentage passing)**
38 mm (1.5")	100
13 mm (0.5")	75-100
4.75 mm (#4)	50-80
75 µm (#200)	10-25

In addition, the material should be relatively non-expansive, granular, having a minimum Sand Equivalent of 21, and should be reviewed by the engineer.

It is not possible to develop or recommend different mix specifications for the base soil cover. This should be a "design-build" criterion that identifies the minimum percolation range at a specified relative compaction. This approach allows the contractor to find the proper soil types to meet the project needs.

Therefore it is imperative that the contractor understands that it is his responsibility to find the source and provide the appropriate soil material that meets the above grading and quality requirements. In addition, the material should be laboratory tested in advance by the contractor at different values of Relative Compaction (recommended range is 90 to 95%) and proven to satisfy the percolation criterion. A quality assurance program should be considered during construction, in order to verify that all performance criteria are met.

We should note that special consideration should be given for the long-term performance of the wetland. Organic material, dust and/or debris will be accumulating at the bottom of the wetland over the years because of the plants, the wind blown debris, human activities, etc. In addition, decomposition of organic substances will facilitate the creation of a layer on the bottom of the wetland, which may dramatically alter the initial design assumptions regarding the wetland hydrologic performance. For this purpose, we recommend that the design account for soil depositions and appropriate maintenance.

Stability, Bulking and Compaction

We have already performed slope stability analyses (static case and pseudostatic case – 0.12g & 0.20g), which were presented in our final report, dated December 7, 2000. We have conducted the slope stability analysis using the program PCSTABL. The slope stability analysis method described by the U.S. Army Corps of Engineers is mainly applicable for earth levees, so it was not used for the needs of this project.

Please, note also that in our slope stability evaluation we have assumed a 2:1 continuous slope with a maximum height of 20 feet. These preliminary assumptions considered are apparently more conservative than the actual profile shown in the conceptual cross-section provided by PWA (4:1 (H:V) maximum slope, 8 feet-high). Consequently, we believe that the stability of the wetland slopes should not be a major concern.

Geotechnical recommendations for compaction of the soil cover are provided in the previous section, "Wetland Soil Cover Specifications". Areas to receive engineered fill should be excavated to remove any and all loose/soft soils. The resulting surface upon which fill is to be placed should be observed by the engineer. Areas receiving fill should be scarified, moisture conditioned and compacted to 95% Relative Compaction per ASTM specifications.

Erosion Control

The base soil cover will be covered with "growing medium" for vegetation and surface treatment. This material should be designed to mitigate surface erosion. Also, seasonal water fluctuation should be considered so that the top cover does not crack and swell resulting in rapid degradation.

Seepage Analysis

We have conducted a seepage analysis for the proposed base soil cover. The software program used for the analysis was SEEP2D, which is a two-dimensional finite element analysis program. The soil profile provided by PWA on Figure 3, Conceptual Cross-Section AA', formed the basis of our analysis. Only deviation from the above geometry was that a uniform thickness of one-foot was used for the soil cover throughout the cross-section, instead of a varying thickness of 1 to 1.5 feet. The concept was that any soil layer placed and moderately compacted on top of the one-foot base cover (e.g. for vegetation establishment) will not contribute significantly on retention, in other words percolation rate would probably be controlled by the recommended one-foot thick compacted base soil cover. For our analysis we considered that the water level in the wetland remains at Elev. +243 feet. We also placed the groundwater table at Elev. +236 feet, corresponding to a depth of 8 feet below the ground surface (ground elev. +244 feet at the conceptual drawing). This matches with the highest water level measured, according to our ground water monitoring (February 21, 2001).

The analysis was performed for unconfined conditions, considering flow in the saturated and the unsaturated zone. We assumed isotropy and homogeneity. The borderline between saturated and vadose zone (ground water table) is shown on the attached Figure 1, Pressure Head, as the line corresponding to pressure head equal to zero. Figure 2, presents the flowline pattern. Figure 3 shows the equipotential lines, which range from Total Head=243 feet at the wetland surface to Total Head=236 at the boundaries of the profile. Total flowrate from the wetland was calculated on the order of 132 $(ft^3/day)/ft$, using a target percolation rate of 0.3 ft/day for the soil cover.

In conclusion, a one-foot thick soil cover with the specifications presented herein, placed over the whole area of the proposed wetland should satisfy the needs for hydrologic performance and structural integrity. On top of this base cover we recommend another layer, with a varying thickness between 4 inches (deep open water areas) and 12 inches (tall emergent wetland/riparian areas), which should be moderately compacted and should serve for the colonization by the feeding and burrowing species and vegetation establishment, respectively.

Warranty: Please be advised that we are performing a professional service and that our conclusions are professional opinion only. All work done and all recommendations made are in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work.

If you have any questions, please feel free to contact this office.

Very truly yours,
PARIKH CONSULTANTS, INC.

Apostolos V. Kozompolis

Apostolos V. Kozompolis
Staff Engineer

Gary Parikh, P.E., G.E. 666
Project Manager

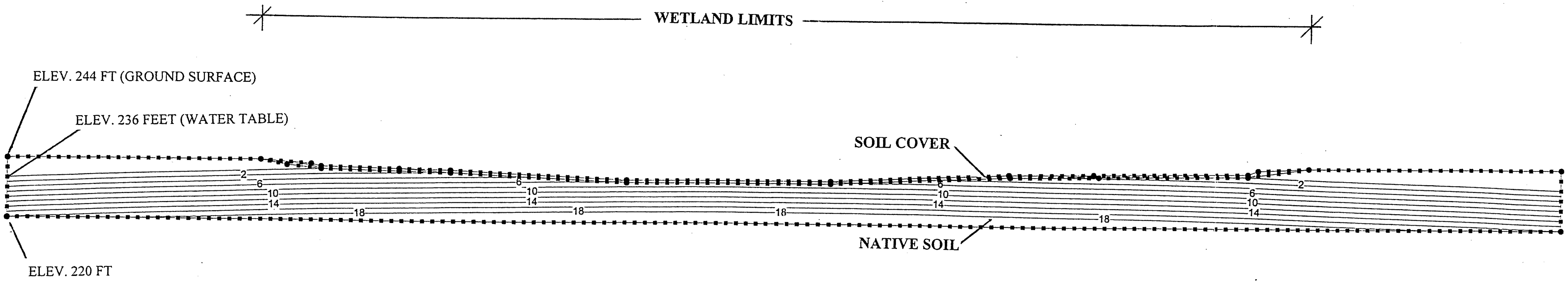
REGISTERED PROFESSIONAL ENGINEER
GAURANG R. PARIKH
No. 666
EXP. 12-31-01
GEOTECHNICAL
STATE OF CALIFORNIA

Attachments: Plate No. 1, Pressure Head
Plate No. 2, Flowlines
Plate No. 3, Equipotential Lines

99154memo.doc {2A}

LOS CAPITANCILLOS FRESHWATER WETLAND MITIGATION PROJECT
SEEPAGE ANALYSIS

Total Flowrate = 132.315 (ft^3/d)/(ft)



LEGEND:

SCALE: 1 INCH = 40 FEET

CONTOURS REPRESENT PRESSURE HEAD IN FEET
NOTE: “0” PRESSURE CONTOUR CORRESPONDS TO GROUND WATER TABLE

PRESSURE HEAD

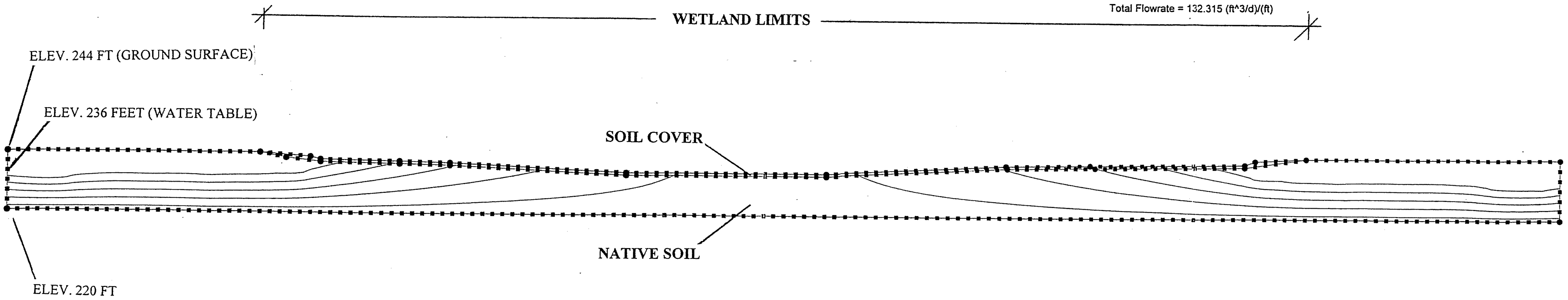
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

LOS CAPITANCILLOS FRESHWATER
WETLAND MITIGATION PROJECT
SAN JOSE, CALIFORNIA

JOB NO.: 99154.10

PLATE NO.: 1

LOS CAPITANCILLOS FRESHWATER WETLAND MITIGATION PROJECT
SEEPAGE ANALYSIS


WETLAND LIMITS
Total Flowrate = 132.315 (ft^3/d)/(ft)
ELEV. 244 FT (GROUND SURFACE)
ELEV. 236 FEET (WATER TABLE)
SOIL COVER
NATIVE SOIL
ELEV. 220 FT

LEGEND:

SCALE: 1 INCH = 40 FEET

NOTE:

FLOWLINES DEFINE FLOW PATHS THROUGH SOIL MEDIA

FLOWLINES

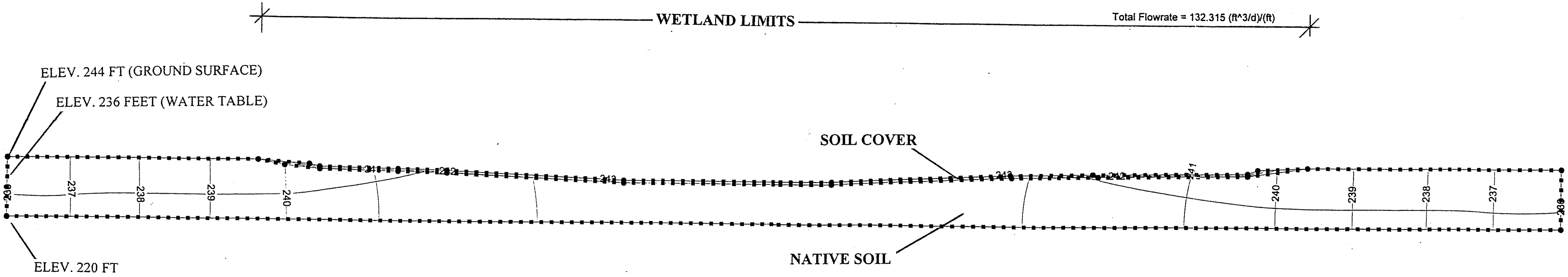
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

LOS CAPITANCILLOS FRESHWATER
WETLAND MITIGATION PROJECT
SAN JOSE, CALIFORNIA

JOB NO.: 99154.10

PLATE NO.: 2

LOS CAPITANCILLOS FRESHWATER WETLAND MITIGATION PROJECT
SEEPAGE ANALYSIS


WETLAND LIMITS
Total Flowrate = 132.315 (ft^3/d)/(ft)
ELEV. 244 FT (GROUND SURFACE)
ELEV. 236 FEET (WATER TABLE)
SOIL COVER
NATIVE SOIL
ELEV. 220 FT
236
237
238
239
240
241
242
243
243
242
241
240
239
238
237
236

LEGEND:

SCALE: 1 INCH = 40 FEET

EQUIPOTENTIAL LINES REPRESENT DROPS IN TOTAL HEAD (FEET).
TOTAL HEAD RANGES BETWEEN 243 (WETLAND SURFACE) AND 236 (WATER TABLE)

EQUIPOTENTIAL LINES

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

LOS CAPITANCILLOS FRESHWATER
WETLAND MITIGATION PROJECT
SAN JOSE, CALIFORNIA

JOB NO.: 99154.10

PLATE NO.: 3

Appendix N

Santa Clara Valley Water District BMPs

2001 SMP Best Management Practices for Bank Protection and Sediment Removal

BMP	Title	Description	Activity
1. Water Quality--The District shall implement measures to protect water quality, to reduce short-term increases in turbidity, and to maintain the geomorphic integrity of the channels.			
1	Tidal Work Areas	For tidal areas, a downstream cofferdam is constructed to prevent the work area from being inundated by tidal flows. By isolating the work area from tidal flows, water quality impacts are minimized. Downstream flows continue through the work area and through pipes within the cofferdam. a) Installation of coffer dams will begin at low tide. b) If work can be completed or staged when the work area is not under water, coffer dams will not be necessary.	Both
2	Dewater/ Bypass Water at Non-tidal Sites	If water is present at the work site, diversion structures (which can be made of various materials) will be constructed, as needed, to isolate the work area and avoid or minimize downstream water quality impact. Depending on the channel configuration, water is allowed to either continue flowing downstream or is diverted around the work site in a pipe (pumped or gravity) or open channel. a) All water shall be discharged in a non-erosive manner (e.g., gravel or vegetated bars, on hay bales, on plastic, on concrete, or in storm drains when equipped with filtering devices, etc.). b) Sumps or basins may also be used to collect water, where appropriate (e.g., in channels with low flows). c) Where feasible and appropriate, diversion structures shall be installed on concrete sections of the channels or constructed of materials other than imported earthen fill. If earth is used, the downstream and upstream faces shall be covered by a protected covering (e.g., plastic or fabric) if needed to minimize erosion. d) In conjunction with diversion structures, pumps or gravity-fed pipe systems are used to dewater sites. e) Depending on the channel configuration, sediment removal may occur within a live stream where the flows are not bypassed around the work site; however, during excavation activities, a berm of sediment is left between the work area and stream flows to minimize water quality impacts.	Both
3	Avoid Erosion When Restoring Flows	All temporary diversion structures shall be removed. Flows shall be restored in a manner that minimizes erosion. a) When diversion structures are removed, to the extent practicable, the ponded flows will be directed into the low-flow channel within the work site to minimize downstream water quality impacts. b) Flows shall gradually be restored to the channel to avoid a surge of water that would cause erosion or scouring. c) Bypassed flows can be slowly reintroduced into the dewatered area by leaving a silt barrier in place to allow water to slow and drop sediment to the extent possible.	Both
4	Erosion and Sediment Control Measures	Erosion control methods shall be used as appropriate during the construction phase to control sediment and minimize water quality impacts. The District shall prevent erosion on steep slopes by using erosion control material according to manufacturer's specifications. Appropriate measures include, but are not limited to, the following: a) Silt Fences b) Straw Bale Barriers c) Brush or Rock Filters d) Storm Drain Inlet Protection e) Sediment Traps f) Sediment Basins g) Erosion Control Blankets and Mats The following Bay Area Stormwater Management Agency Association BMPs	BP

2001 SMP Best Management Practices for Bank Protection and Sediment Removal			
BMP	**Title**	**Description**	**Activity**
		provide guidance and specifications as to implementation of the erosion control measures described: SC-3. Sediment Basins SC-4. Straw or Sand Bag Barriers SC-5. Sediment Traps SC-6. Silt Fences SS-1. Erosion Control Blankets, Mats, and Geotextiles VR-1. Brush or Rock Filters VR-2. Check Dams VR-4b. Temporary Outlet Protection VR-4b. Storm Drain Inlet Protection WD-1. Earth Dike WD-1. Slope Drain WD-3. Temporary Drains and Swales	
5	Use of Wheel and Track Mounted Vehicles in Stream Bottoms	District personnel shall use the appropriate equipment for the job that minimizes disturbance to the stream bottom. Appropriately-tired vehicles, either tracked or wheeled, shall be used depending on the situation: a) Use of tracked vehicles shall focus on selecting low ground pressure equipment and, when possible, avoiding areas where channel topography would be unduly impacted by equipment. b) When possible, tracked equipment will be chosen in lieu of wheeled vehicles in areas where soil types are highly susceptible to compaction.	Both
6	Pump/ Generator Set Operations and Maintenance	Pumps and generators shall be maintained and operated in a manner that minimizes impacts to water quality and aquatic species. a) Pumps and generators shall be maintained according to manufacturer's specifications to regulate flows to prevent dryback or washout conditions. b) Pumps shall be operated and monitored to prevent low water conditions, which could pump muddy bottom water, or high water conditions, which creates ponding. c) Pump intakes shall be screened to prevent uptake of fish and other vertebrates.	Both
7	Pump intake clearance structure	Pump clearance systems will be used in creeks fines at the pump intake location. Mount pump to pallet or other suitable base platform to provide clearance from channel bottom, which will reduce high velocity around pump intake.	Both
8	Fabric-lined Invert Upstream of Bypass Pump	In streams with ponded water, where pumping action increases velocity in the upstream channel and project inspection shows increased mobilization of sediment fines in flow, filter fabric will be laid in the channel bottom and secured upstream of bypass pump where sediment is mobilizing. Field judgment will be used to determine where sediment is mobilizing.	Both
9	Handle Sediments So As to Minimize Water Quality Impacts	Sediments shall be stored and transported in a manner that minimizes water quality impacts. a) Wet sediments may be stockpiled outside of a live stream or may be stockpiled within a dewatered stream so water can drain or evaporate before removal. This measure is dependent upon the availability of a stockpile site. b) Temporary stockpiles will be isolated. c) Trucks may be lined with an impervious material (e.g., plastic), or the tail gate blocked with dry dirt or hay bales, for example, or trucks may drain excess water by slightly tilting their loads and allowing the water to drain out. d) Water shall not drain directly into channels (outside of the work area) or onto city streets without providing water quality control measures. e) Streets shall be cleaned of mud and/or dirt by street sweeping, as necessary, and not by hosing down the street.	SR

BMP	Title	Description	Activity
10	Soil Stockpiles	If soil is to be stockpiled, no run-off will be allowed to flow back to creek outside of the work area in which water quality BMPs have been implemented.	SR
11	Avoid Exposing Soils with High Mercury Levels	Bank Protection projects in portions of the Guadalupe River watershed affected by historical mercury mining may expose soils containing mercury which can affect stream water quality. In the specified channel reaches in the Guadalupe River Basin, soils that are likely to be disturbed or excavated shall be tested for Mercury (Hg). Soils shall be remediated if: a) Disturbed or excavated soils exposed to flood flows below the 2.33-year channel flow level exceed 1 ppm Hg, or b) Disturbed or excavated soils above the 2.33-year flow level exceed 20 ppm Hg. C. Remediation can be accomplished either by: 1) treating the site so that contaminated soils excavated for the purpose of installing bank protection will not be susceptible to erosion, or 2) by further excavating contaminated soils and replacing them with clean fill or other bank protection materials that are free from contaminants.	BP
12	Concrete Use Near Waterways	Concrete that has not been cured is alkaline and can increase the pH of the water; fresh concrete will be isolated until it no longer poses a threat to water quality. a) Use plastic sheeting or otherwise isolate concrete that is used in channels for 2 weeks to one month to allow time for curing. b) Designate an area outside of the channel and floodplain to clean out concrete transit vehicles.	BP
13	Groundwater Management	If high levels of groundwater in a work area are encountered, the water may be pumped out of the work site. If necessary to protect water quality, the water shall be directed into specifically constructed infiltration basins, into holding ponds, or onto areas with vegetation to remove sediment prior to the water re-entering a creek.	Both
14	Prevent Scour Downstream of Sediment Removal	Sites in the transport zone on alluvial fans may cause increased scour downstream if they experience rapid sediment accumulation after sediment removal. Channel reaches up to 500 feet downstream from such sediment removal sites will be monitored to determine whether accelerated erosion is occurring. If downstream monitoring indicates that erosion is occurring, then remedial action such as rock vortex weirs or similar protection shall be carried out.	SR
2. Vegetation -- The District shall strive to minimize vegetation removal and shall revegetate sites as appropriate to provide erosion control and restore riparian habitat value.			
15	Minimize Stream Access Impacts	District personnel shall use existing access ramps and roads where possible. If new access points are necessary, they shall be constructed in a manner that minimizes impacts to streams: a) New access points shall be created as close to the work area as possible to minimize running equipment down stream channels. b) On temporary access points, remaining disturbed soil shall be compacted and re-vegetated as soon after construction as is horticulturally appropriate. c) New access points will be constructed so as to minimize adverse impacts, such as tree removal, whenever possible. d) If the access point is to be permanent, the road or ramp will have a gravel surface. e) Any temporary fill used for access shall be removed upon completion of the project. Channel topography and geometry shall be restored to pre-project conditions to the extent possible.	Both

BMP	Title	Description	Activity
3. Wildlife and Fisheries -- The District shall implement measures to minimize impacts to native species, especially special-status and riparian dependant species.			
16	Minimize Impacts to Special-status Plants and Animals Via Site Assessments and Avoidance Measures	To avoid and minimize impacts to special-status plant and wildlife species, the annual work program shall be reviewed, and each site where special status species have been found, have been known to exist in the recent past, or are likely to occur because suitable habitat exists, will be visited by a biologist or qualified personnel under the direction of a biologist. For animal species the site surveys will be no more than 30 days prior to the start of construction to determine presence of special-status species. For plant species the surveys will be conducted during the appropriate time of the year to determine presence. Information regarding the presence of special-status species on a particular worksite shall be based on the District's GIS database and professional experience of qualified staff. a) If maintenance activities are scheduled in the vicinity of extant populations, qualified personnel under the direction of a biologist will clearly identify the populations on site and stake or flag a buffer zone around the population in which activities are to be avoided. b) If sensitive animals such as western pond turtles or California red-legged frogs are found, a qualified biologist will remove them to suitable habitat outside of the project limits. Moving animals will be consistent with applicable Fish and Wildlife Service and Fish and Game permits. c) The results of all sensitive species surveys will be reported to the Fish and Wildlife Service and the California Department of Fish and Game in an annual report. All surveys will be reported to the CNDDB.	Both
17	Minimize Impacts to Breeding Birds Via Site Assessments and Avoidance Measures	Work will be conducted in a manner consistent with the protocols established by the most current version of the District's Nesting Migratory Bird Procedure: a) Project areas will be checked by qualified personnel under the direction of biologists for nesting birds prior to starting work if the work has the potential to impact breeding birds. b) If nesting birds are found, implementation of a project may be delayed until after nesting is completed. Work may occur if an adequate buffer, as determined by a qualified biologist, can be established between the maintenance activity and nests.	Both
18	Salvage Native Aquatic Vertebrates from Dewatered Channels	If fisheries or native aquatic vertebrates are present when cofferdams, water bypass structures, and silt barriers are to be installed, a fish and native aquatic vertebrate relocation plan will be implemented to ensure that fish and native aquatic vertebrates are not stranded: a) In non-tidal channels, where water is to be diverted, prior to the start of work or during the installation of water diversion structures, native aquatic vertebrates will be captured in the work area and transferred to another reach as determined by a qualified biologist b) Aquatic invertebrates will not be transferred (other than incidental catches) because of their anticipated abundance and colonization after completion of the repair work.	Both
19	Minimize Effects of Bypass Structures on Steelhead	To prevent increases in temperature and decreases in dissolved oxygen (DO), if bypass pipes are used, they shall be properly sized (i.e., larger diameter pipes to better pass the flows). Bypass pipes may also be avoided by creating a low-flow channel or using other methods to isolate the work area.	Both

BMP	Title	Description	Activity
20	Conduct In-Channel Work During the Dry Season	Avoid and minimize impacts to steelhead by timing stream maintenance projects in streams where there are or could be steelhead so that the use of heavy equipment in the channel is conducted outside of the migration and spawning season. a) Steelhead migration and spawning season is generally between December 15 to June 30.	Both
21	Remove Temporary Fills as Appropriate	Temporary fills, such as for access ramps, diversion structures, or cofferdams, shall be completely removed upon finishing the work, except where clean river run cobble/gravel was used. When appropriate, some or all of such material may be left in the channel to provide a substrate for aquatic species.	Both
22	Restore Riffle and Pool Configuration of Channel Bottom	The District shall re-grade the channel bottom at the end of the work project to as close to original conditions as possible. a) In areas used for migration by salmonids as designated on the District GIS Fisheries coverage, the depth and size of the low flow channel and pools shall emulate the pre-construction conditions as closely as possible, within the finished channel topography. b) In areas potentially used for spawning by salmonids as designated on the District GIS Fisheries coverage, spawning riffles impacted by channel maintenance activities will be re-created by placement of a suitably sized gravel-cobble mixture in a configuration that equals or exceeds the pre-project available area (see also BMP 22).	Both
4. Land Use and Public Safety -- The District shall minimize disturbance to the public and ensure public safety.			
23	Notify Local Governments of Scheduled Work	Notify cities and the County of proposed work by submitting the Annual Work Plan to the Public Works Departments and the District's Zone Advisory Committee.	Both
24	Minimize Disturbances to Surrounding Neighborhoods	The District shall implement maintenance practices that minimize disturbances to neighborhoods surrounding work sites. a) In general, work shall be conducted during normal working hours. Extending weekday hours and working weekends may be necessary to complete some projects. b) Internal combustion engines shall be equipped with adequate mufflers. c) Excessive idling of vehicles will be prohibited. d) Levee traffic shall be limited to a speed of 15 miles per hour. e) Access roads shall be watered as needed to control dust. f) Dry sediment shall be wetted down or covered as needed to control dust during transport.	Both
25	Stabilized Construction Entrance	The District shall implement measures to minimize soil from being tracked onto streets near work sites: a) Methods used to prevent mud from being tracked out of work sites onto roadways include installing a layer of geotextile mat, followed by a 4-inch thick layer of 1to 3-inch diameter gravel on unsurfaced access roads where necessary; extensive sweeping can be substituted where there are stable road surfaces in the access. b) Access shall be provided as close to the work area as possible, using existing ramps where available and planning work site access so as to minimize disturbance to the creek bed, creek banks, and the surrounding land uses.	Both
26	Sanitary/Septic Waste Management	Temporary sanitary facilities shall be located on jobs that last multiple days. All temporary sanitary facilities shall be placed outside of the creek channel and floodplain.	Both

BMP	Title	Description	Activity
27	Vehicle and Equipment Cleaning	District vehicles shall be washed only at the approved area in the corporation yard. No washing of vehicles shall occur at job sites.	Both
28	Work Site Solid Waste Management	District employees and contractors shall clean the work site before leaving by removing all litter and construction related materials. The District's maintenance crews shall be responsible for all debris incurred as a result of construction and for cleaning up dumped material.	Both
29	Implement Public Safety Measures	The District shall implement public safety measures during maintenance: a) Construction signs shall be posted at job sites warning the public of construction work and to exercise caution. b) When necessary, a person shall be provided for traffic control. c) If needed, a lane shall be blocked off to allow for trucks to pull into and out of the access points. d) Where work is proposed adjacent to a recreational trail, warning signs shall be posted several feet beyond the limits of work. e) Fencing, either the orange safety type or chain link, shall be installed above repair sites on bank stabilization projects. f) Where projects are adjacent to schools, hours of ingress and egress to the site shall avoid peak periods of school traffic in the morning and afternoon to the maximum extent possible.	Both
5. Air Quality-- The District shall implement dust control measures at work sites to protect air quality and minimize effects on adjacent neighborhoods.			
30	BAAQMD Basic Dust Control Measures	The District shall implement BAAQMD Basic Control Measures at maintenance sites less than four acres in size. Current measures stipulated by the BAAQMD CEQA Guidelines include the following: a) Active maintenance areas shall be watered at least twice per day unless soils are already sufficiently moist to avoid dust. b) Trucks hauling sediments and other loose material shall be covered or shall maintain at least two feet of freeboard. c) Tailgates of trucks shall be sealed. d) Trucks shall be brushed down before leaving the maintenance site. e) Unpaved access roads and staging areas that are being used for the maintenance activity shall be watered three times daily, or non-toxic soil stabilizers shall be applied to control dust generation. f) Paved maintenance site access roads shall be swept when visible soil material is carried onto the roadway.	Both
31	BAAQMD Enhanced Dust Control Measures	For single maintenance sites greater than four acres, the District shall implement BAAQMD Enhanced Dust Control Measures. These measures include the following: a) Inactive areas shall be sprayed with soil stabilizer or seeded. b) Exposed stockpiles shall be watered, enclosed, covered, or sprayed with soil stabilizers. c) Traffic speeds shall be limited to 15 mph. d) Sandbags or other bank protections shall be installed to prevent silt runoff to roadways. e) Vegetation in disturbed areas shall be replanted as soon as horticulturally appropriate. For example, plant material may not be ready as soon as the job is done (e.g. willow cuttings have to be collected during winter dormancy).	Both
32	Avoid Stockpiling Potentially Odorous Sediments	Some of the sediment removal sites will have sediment that is rich in organic matter decaying in an anaerobic condition, which generates assorted malodorous gases, such as reduced sulfur compounds. These sediments shall be handled in a manner that avoids impacting sensitive receptors. a) The District shall avoid stockpiling potentially odorous sediments	SR

BMP	Title	Description	Activity
		within 1000 feet of residential areas or other odor sensitive land uses. b) Where appropriate, odorous stockpiles shall be disposed of at an appropriate landfill.	
6. Hazardous Materials -- The District shall implement hazardous materials protocols to protect environmental quality and public safety.			
33	Spill Prevention	The District shall prevent the accidental release of chemicals, fuels, lubricants, and non-storm drainage water into channels. a) District field personnel will be appropriately trained in spill prevention, hazardous material control, and clean-up of accidental spills. b) No fueling, repair, cleaning, maintenance, or vehicle washing shall be performed in the creek channel or in areas at the top of the channel bank that may flow into the creek channel unless adequate portable containment procedures are implemented.	Both
34	Spill Kit Location	Spill prevention kits shall always be in close proximity when using hazardous materials (e.g., crew trucks and other logical locations). a) Prior to entering the work site, all field personnel will know the location of spill kits on crew trucks and at other locations within District facilities. b) All field personnel will be advised of these locations and trained in their appropriate use.	Both
35	Hazardous Waste Management	The District shall implement measures to ensure that hazardous materials are properly handled and the quality of water resources is protected by all reasonable means when removing sediments from the streams. a) Prior to entering the work site, all field personnel will know how to respond when toxic materials are discovered. b) The discharge of any hazardous or non-hazardous waste as defined in Division 2, Subdivision 1, Chapter 2 of the California Code of Regulations shall be conducted in accordance with applicable State and federal regulations. c) All handling and disposal of sediments shall be performed in accordance with the WDR issued by the RWQCB. The sediment shall ultimately be disposed at a permitted landfill. Any alternative use or disposal will require RWQCB approval.	Both
36	Vehicle and Equipment Fueling	No fueling shall be done in the stream channel and floodplain. Except, fixed equipment (such as pumps and generators) that are placed for extended periods during a job can be fueled in place provided that containment is accomplished per BMP 33. All mobile equipment (such as trucks, excavators, loaders, etc.) shall be pulled or driven out of the channel and floodplain areas for refueling.	Both
37	Vehicle and Equipment Maintenance	No equipment servicing shall be done in the stream channel and floodplain. Except, fixed equipment (such as pumps and generators) that are placed for extended periods during a job can be serviced in place provided that containment is accomplished per BMP 34. All servicing of equipment will be done so that hydrocarbon based lubricants are not introduced into areas that may run into the stream.	Both
7. Cultural Resources -- The District will protect cultural resources.			
38	Discovery of Cultural Remains or Historical Artifacts – previously improved channels	If historic or archaeological resources are uncovered during project implementation, all work shall stop and the District shall retain a qualified archaeologist. All workers who will be assigned to the projects shall attend an orientation to archaeological evidence so that they will be equipped to make preliminary identification of potential archaeological issues. The archaeologist will perform an archaeological reconnaissance and develop mitigation measures to protect archaeological resources pursuant to BMP 39.	Both

BMP	Title	Description	Activity
39	Discovery of Cultural Remains or Historic Artifacts – previously unimproved channels	In unimproved channels, and where historical or archaeological artifacts are found, work in areas where remains or artifacts are found will be restricted or stopped until proper protocols are met. a) Work at the location of the find will halt immediately within 30 feet of the find. If an archaeologist is not present at the time of the discovery, SCVWD will contact an archaeologist for identification and CEQA evaluation. b) If the find is not significant, construction can continue. The archaeologist will prepare a brief informal memo/letter that describes and assesses the significance of the resource, including a discussion of the methods used to determine significance for the find. c) If the find appears significant, the archaeologist will determine if the resource can be avoided and will detail avoidance procedures. d) If the resource cannot be avoided, the archaeologist will develop within 48 hours an Action Plan to avoid or minimize impacts. The SCVWD field crew will not proceed until the Action Plan is approved by the SCVWD Watershed Manager. e) The recovery effort will be detailed in a report prepared by the archaeologist in accordance with current archaeological standards. Any non-grave artifacts will be placed with an appropriate repository. f) In the event of discovery of human remains, the field crew supervisor shall take immediate steps to secure and protect such remains. g) The Santa Clara County Coroner shall be notified and informed of the find and of any efforts made to identify the remains as Native American. If the remains are determined to be from a prehistoric Native American, the medical examiner is responsible for contacting the Native American Heritage Commission (NAHC) within 24 hours of notification. The NAHC then designates and notifies within 24 hours a *Most Likely Descendant* (MLD). The MLD has 24 hours to consult and provide recommendations for the treatment or disposition, with proper dignity, of the human remains and grave goods. h) Preservation in situ is the preferred option, and if the District can do this without incurring potential future disturbance, then the MLD will usually recommend no further action. The remains and artifacts will be documented and the find location carefully backfilled to avoid further disturbance. i) Human remains or cultural items exposed during maintenance that are subject to further disturbance will be exhumed archaeologically at the discretion of the MLD and reburied with the concurrence of the MLD in a place mutually agreed upon by all parties.	Both